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Holistic Health through Physical Fitness: Ergonomic Interventions

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Abstract : *Holistic Health is actually an approach to life which rather than focusing on illness or specific parts of the body, this ancient approach to health considers the whole person and how he or she interacts with his or her environment. The present investigation was aimed to explore the variables that contribute towards developing Work related Musculoskeletal Disorders (WMSD) among women involved in packing activities in pharmaceutical industry and develop guidelines for ergonomic interventions to control and prevent WMSD. In the present study it was found that physical fitness and occupational health of the person are very important factors in contributing holistic wellness of the person. In pharmaceutical industry mostly women are engaged for sedentary and repetitive manual work. Though the process of manufacturing is mechanized, the process of packing is still undertaken manually. The majority of packing activities are characterized by a sitting posture, worker's head and trunk flexed forward and shoulders flexed and abducted. In this posture high rate of work related musculoskeletal disorders occurrence could be expected. Musculoskeletal disorders being one of the serious occupational health hazard effecting the health of women in particular needs to be focused as women are the key factors in the very basic unit of the society, the family.*

Key words: *Physical fitness, Work related Musculoskeletal Disorders, Ergonomics.*

Introduction

In India occupational health is not integrated with primary health care, and it is the mandate of the Ministry of Labour, not the Ministry of Health. Enforcement is carried out through the Directorate of Industrial Safety and Health at state levels that operate through factory inspecting engineers and medical inspectors of factories. The World Health Organization estimates occupational health risks as the tenth leading cause of morbidity and mortality. According to World Health Report occupational risk factors account globally for a number of morbid conditions, including back pain (37%), hearing loss (16%), chronic obstructive lung disease (13%), asthma (11%), injuries (10%), cancer (9%) and leukaemia (2%) (WHO, 2001).

Fitness is defined as the capacity to carry out the day's activities without undue fatigue. Physical fitness is considered as a measure of the body's ability to function efficiently and effectively in work and leisure activities, to be healthy, to resist hypokinetic diseases, and to meet emergency situations (Wales, 2011).

Objectives

The present research aimed

1. To find out the interrelationship that exists between the physical fitness and extent of prevalence of work related musculoskeletal symptoms.
2. To find out the interrelationship that exists between the physical fitness and extent of prevalence of work related musculoskeletal disorders.
3. To find out the interrelationship that exists between the physical fitness and loss of physical functioning.
4. To develop guidelines for ergonomic interventions to control and prevent the work related musculoskeletal disorders to acquire holistic health.

Review of literature

Physical capacity is a measure of the ability of active muscle systems to deliver, by aerobic metabolism or anaerobic metabolism, energy for mechanical work, and to continue working for as long as possible (Morken *et al.,* 2007).

Morken *et al.* (2000) studied on the prevalence of musculoskeletal symptoms among aluminium workers. The physical capacity of the subjects was studied. Correlation analysis showed that physical capacity was correlated negatively with musculoskeletal symptoms in the head, neck, hands, upper back and lower back. Respondents who were physically active perceived low level of musculoskeletal symptoms.

Materials and Methods

Area of the study: Hyderabad has emerged as a major drug manufacturing city with presence in the global market. In view of the research undertaken, Hyderabad was selected to draw the sample for the present investigation.

Criteria for selection of sample: Physiological and biological changes related to ageing may cause degenerative changes in the muscles, tendons, ligaments and joints which may contribute to the pathogenesis of MSD (Cassou *et al.*, 2002). Hence, age was identified as a criterion in selecting the sample. The women who were involved in the packing activities in pharmaceutical industries for a period of minimum three years and aged above 30 years was the criteria adopted to select the sample for the study.

Selection of localities: The localities of pharmaceutical industries in Hyderabad were collected from the office of Commissioner of Industries. The industries were located in Jeedimetla, Kazipally/Bonthapally/Gaddapotharam, Bollaram, Choutuppal, Mallpur/Nacharam, Pashamylaram/Patancheru and Uppal areas. Industries situated in all these areas were considered while identifying sample.

Selection of pharmaceutical industries: The medium and small units involved in bulk manufacturing and formulations were approached personally for permission to carry out the investigation. Nine pharmaceutical industries that were willing to participate in the study were chosen for the investigation.

Selection of sample: The sample was chosen through simple random sampling technique considering the criteria adopted for selecting the sample. The utmost important consideration is cooperation of the respondents as the research involved medical examination. The women satisfying the criteria and willing to participate in the study in each industry ranged from 35-45. The total

population of the study consisted of 360 women from the nine selected industries. From the total study population 75 percent i.e. 270 women were chosen at random to form the sample for the present investigation.

Method of measuring Physical Fitness Index (PFI)

Physical Fitness Index is the independent variable considered for the present study. The standardized PFI method (Varghese *et al.,* 1994) by using Step Stool Ergometer was adopted to measure PFI in the present investigation. Wooden Stool Ergometer with 45 cm length, 30 cm breadth and 24 cm height was used for testing the physical fitness. After the resting phase, body weight, height, oral temperature, blood pressure and heart rate of the respondents were measured. The subjects were asked to perform the stepping activity on the Ergometer with 99^0C body temperature, with 120/80 (+or- 10) blood pressure, with heart rate not above 90beats/min. The duration of stepping was maximum 5 minutes with a stepping rate of 30steps/min. With the help of Pulse Rate Monitor the heart beat was recorded for every 5 minutes during rest period, stepping activity and recovery period.

The physical fitness score was calculated using the following formula.

$$PFI = \frac{\text{Duration of stepping (sec.)}}{\text{Sum of } 1^{st}, 2^{nd} \text{ and } 3^{rd} \text{ min recovery phase count}} \times 100$$

The scores obtained were interpreted using the Physical Fitness Index scores. Up to 80 was considered as poor physical fitness score. The scores 81-100, 101-115, 116-135, 136-150 and >150 were interpreted as low average, high average, good, very good and excellent.

Scale for measuring Work related musculoskeletal disorders

The extent of prevalence of work related musculoskeletal disorders was selected as a dependent variable to find out the factors that contribute toward developing WMSD among women working in the packing activities. For the present investigation, the WMSD were identified at three levels. Work related musculoskeletal disorders start with symptoms of pain, stiffness, swelling, spasms, cramps, numbness, tingling sensation, soreness, heaviness, burning and tenderness in nine anatomical body regions. An individual with musculoskeletal symptoms when continue to work along in the same working conditions over a period of time may develop musculoskeletal disorders (MSD). When the subject is not treated for MSD or without any intervention to prevent or control MSD the chances of loss of physical functioning of nine anatomical body regions may occur (National Research Council, 1998). In the present investigation the dependent variable MSD is measured in terms of

musculoskeletal symptoms, musculoskeletal disorders and loss of physical functioning. These three variables were considered separately as dependent variables under the present investigation.

The first section of the scale is intended to measure the extent of musculoskeletal symptoms experienced by the subjects in nine anatomical body regions. The respondents were asked to indicate the level of discomfort experienced in terms of always, frequently, sometimes, rarely and never depending on the degree of symptom. To obtain uniformity in the responses of the subjects, the guidelines were set for the level of discomfort. The respondents were asked to mark 'always' in case they experience the musculoskeletal symptoms throughout the week in the respective body part. If the frequency of experiencing the symptoms is 3-4 days in a week they were asked to mark 'frequently'. When the frequency of experiencing the pain is 1-2 days in a week, few hours in a week and never in a week, the respondents were asked to indicate sometimes, rarely and never respectively. The response categories 'always', 'frequently', 'sometimes', 'rarely' and 'never' were given scores 5,4,3,2,1 respectively. The scores were interpreted such that the higher the score higher the extent of musculoskeletal symptoms experienced in respective anatomical body regions. The possible score range for neck, shoulder, upper limb, back and lower limb symptoms were 9-45, 9-45, 12-60, 9-45 and 11-55 respectively.

The second section of the scale was designed to identify the musculoskeletal disorders experienced by the subjects due to their nature of work. The work related musculoskeletal disorders in nine anatomical body regions were identified with the help of medical practitioners. The stage of presence of each disorder was identified with the help of a medical practitioner. The various stages identified were early stage, intermediate stage and late stage. Depending on the severity of the disorder the scores 1, 2, 3, 4 were allotted for nil, early stage, medium stage and late stage respectively. The possible score range for neck, shoulder, upper limb, back and lower limb disorders were 5-20, 3-12, 12-48, 2-8 and 8-32 respectively. The high score denotes that the disorder is at an advanced stage. Depending on the score earned by the respondent, the stage of musculoskeletal disorder in respective body region was identified.

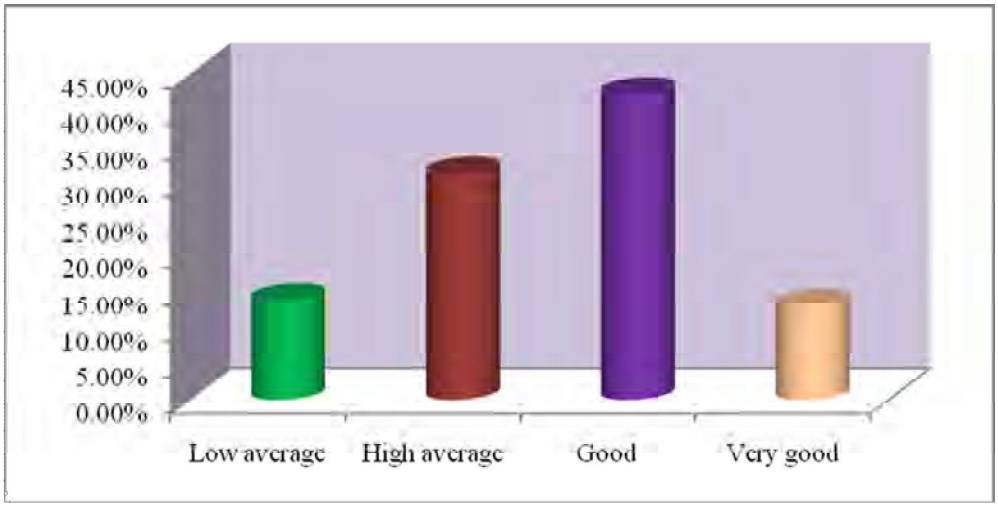
The third section of the scale was designed to measure the extent of loss of physical functioning of neck, shoulder, upper limb, back and lower limb. To measure the extent of loss of physical functioning of each of the body region respondents were asked to indicate the level of difficulty to perform the identified activities with reference to each body part. The responses of the subjects were categorised as no difficulty, mild difficulty, moderate difficulty, severe difficulty and very severe difficulty to the extent of inability to perform the activity. Scores 1, 2, 3, 4, 5 were allotted respectively from no difficulty to very severe difficulty. The scores were interpreted such that the higher the score higher the extent of loss of physical functioning of respective musculoskeletal region. The possible score range for loss of physical functioning in neck, shoulder, upper limb, back and lower limb ranged between 5-25, 7-35, 28-140, 6-30and 8-40 respectively.

Results and Discussion

Work related musculoskeletal disorders occur when there is a mismatch between the physical requirements of the job and the physical capacity of the human body. These are a group of painful disorders of muscles, tendons, and nerves (OSHA, 2000). Movements like bending, gripping, holding, twisting, clenching, squatting, kneeling and reaching form a part of packing activities in pharmaceutical industries. These common movements may lead to work related musculoskeletal disorders (WMSD).

Physical fitness of the respondents

Physical fitness index score of the respondents was categorized as low average, high average, good and very good. The physical fitness index of the respondents varied from 81 to 150 denoting low average to very good physical fitness. About 42.22 per cent of the respondents were categorized as having good physical fitness. The other respondents were having high average (31.11%), low average (13.70%) and very good (12.96%) physical fitness respectively. The mean physical fitness index estimated was 117.14 with a standard deviation of 12.85.



Distribution of sample by Physical Fitness Index (PFI) score (N=270)

In the present investigation majority of the sample was having good physical fitness which is a good sign of physical health. Women involved in packing activities of pharmaceutical industries were found with good physical fitness.

Interrelationship between Physical fitness index and Musculoskeletal Symptoms

The mean physical fitness index of the women involved in packing activities in pharmaceutical industry was 117.14. Physical fitness index of the respondents showed significant negative correlation with musculoskeletal symptoms in neck (r=-0.28), shoulder (r=-0.32), upper limb (r=-0.21), back (r=-0.21), lower limb (r=-0.19) and over all body (r=-0.27) (Table 4.30). The computed F values revealed significant

mean differences between physical fitness index and musculoskeletal symptoms in all regions viz. neck, shoulder, upper limb, back, lower limb and over all body.

The women with low average PFI were frequently experiencing musculoskeletal symptoms in neck, shoulder, upper limb, back, lower limb and over all body. The women with high average PFI and good PFI were sometimes experiencing musculoskeletal symptoms in neck, shoulder, upper limb, back, lower limb and in over all body. The women with very good PFI were rarely experiencing musculoskeletal symptoms in neck, shoulder, upper limb, back, lower limb and in over all body.

According to the present investigation as physical fitness index score increased the musculoskeletal symptoms in the women engaged in packing activities of pharmaceutical industries decreased. Physical fitness index was found to be inversely proportional to perceived level of musculoskeletal symptoms. Similar findings were reported by Morken *et al.* (2000) among aluminium workers.

Interrelationship between Physical fitness index and Musculoskeletal Disorders

The mean physical fitness index of the women involved in packing activities in pharmaceutical industry was 117.14. Physical fitness index of the respondents showed significant negative correlation with musculoskeletal disorders in neck (r=-0.28), shoulder (r=-0.27), upper limb (r=-0.31), back (r=-0.17), lower limb (r=-0.28) and over all body disorders (r=-0.33). The computed F values revealed significant mean difference between physical fitness index and musculoskeletal disorders in all regions viz. neck, shoulder, upper limb, back and lower limb. The F value revealed significant difference between physical fitness index and over all body musculoskeletal disorders.

The musculoskeletal disorders experienced by the women in low and high average PFI category were suffering with neck disorders like tension neck syndrome causing prolonged neck pain, stiffness in the neck and muscle tightness; cervical spondylosis causing pain radiating from neck to upper extremity, muscle weakness in upper limb; cervicalgia with limited mobility and pain; trapezius myalgia with pain and tightness in the muscle with palpable tender spots. Among this sample the shoulder disorders viz. thoracic outlet syndrome causing reduced blood flow in the shoulder and arm; shoulder capsulitis causing pain and loss of elevation of shoulder were observed. These women with low and high average PFI were also suffering with upper limb disorders like elbow tendonitis causing slight tenderness and pain, wrist tendonitis causing swelling of tendon, wrist epicondylitis causing weakness in gripping, carpal tunnel syndrome causing pain and numbness in the palm, De Quervain's disease causing inflammation of sheath surrounding thumb. These women with low and high average PFI were also suffering from back disorders viz. Herniated disc causing more pain in thighs, knees and feet, spinal stenosis causing low back pain, leg numbness and tingling. These women with low and high average PFI were also suffering from the lower limb disorders like arthritis causing pain, stiffness at joints; sciatica causing pain in buttocks and legs due to compression of sciatic nerve; degenerative disease breaking joint's

smooth lubricated surface; tendonitis of ankle causing inflammation in Achilles tendon; tarsal tunnel syndrome causing pain due to nerve compression of ankle region. These women were not at all suffering from lower limb disorders like bunions and calluses and corns.

The musculoskeletal disorders experienced by the women with good PFI were in early stage. The women with very good PFI never experienced musculoskeletal disorders.

According to the present investigation as physical fitness index score increased the musculoskeletal disorders in the women engaged in packing activities of pharmaceutical industries decreased. Physical fitness index was found to be inversely proportional to perceived level of musculoskeletal disorders. Women with relatively good health perceived no musculoskeletal disorders. They were able to cope up with work demands.

Interrelationship between Physical fitness index and Functional Limitations

The mean physical fitness index of the women involved in packing activities in pharmaceutical industry was 117.14. Physical fitness index of the respondents showed significant negative correlation with functional limitations in neck (r=-0.25), shoulder (r=-0.31), upper limb (r=-0.22), back (r=-0.24), lower limb (r=-0.22) and over all body (r=-0.28). The computed F values revealed significant mean difference between physical fitness index and functional limitations in all five musculoskeletal regions viz. neck, shoulder, upper limb, back, lower limb and over all body.

According to the present investigation as physical fitness index increased the functional limitations in musculoskeletal regions among the women involved in packing activities of pharmaceutical industries decreased. Good physical fitness helps workers to work without experiencing functional limitations.

Guidelines for ergonomic interventions to control and prevent the work related musculoskeletal disorders to acquire holistic health

Physical fitness as a risk factor

Blood pressure as a risk factor

Proposed ergonomic interventions for the risk factors related to physical fitness index of the respondents.

Risk factors	Ergonomic interventions	
	Administrative	Personal
i)Low physical fitness ii)Low blood pressure iii)High blood pressure.	i) Early reporting of discomforts of the workers to be taken care. ii)Training in improving the worker's health status iii) Health checkups to diagnose the disorders at early stage.	i) Regular exercises for improving physical fitness. ii)Do yoga iii) Taking nutritious foods to increase the fitness. iv)Medication to reduce the BP.

Conclusion

Physical fitness index was found to be inversely proportional to musculoskeletal symptoms, musculoskeletal disorders and functional limitations in musculoskeletal regions of the women. The women with low average PFI were frequently experiencing musculoskeletal symptoms in neck, shoulder, upper limb, back, lower limb and over all body. The musculoskeletal disorders experienced by the women in low and high average PFI category were found to be near to intermediate stage in neck, shoulder, upper limb, back and lower limb regions. Good physical fitness helps workers to work without experiencing functional limitations and acquiring holistic wellness in the body.

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