CHAPTER 2

LITERATURE REVIEW

2.1 GENERAL

This chapter provides various kinds of inter related literatures, which may guide a perception to the present study. The basic requirement of any research is the units of theory, which should be defined with sufficient clarity to enable the researcher to proceed. A comprehensive review of literature is a necessary integral part of any research endeavour, as it helps to identify the gap in research and aids the investigator in designing and analysing research work. It also provides basis for interpretation and discussion of findings. Further, an acquaintance with earlier related studies is necessary to formulate appropriate research methodology. Keeping in mind the objectives set forth for the study, an attempt has been made in this chapter to review the available literature, which has meaningful relevance to the research.

The literature pertaining to the present study is given below in the following headings:

1) Concept and definition of work related musculoskeletal disorder symptoms

2) Awareness of pain symptoms associated with work related musculoskeletal disorders

3) Gender and musculoskeletal disorders
4) Awareness of risk factors and consequences of musculoskeletal disorders

5) Awareness of work related musculoskeletal disorder symptoms among library professionals

6) Influence of work related musculoskeletal disorders on sickness absence

7) Need for musculoskeletal disorder prevention and intervention

2.2 CONCEPT AND DEFINITION OF WORK RELATED MUSCULOSKELETAL DISORDER SYMPTOMS

Work-related diseases may be caused, aggravated, accelerated or exacerbated by workplace exposures and they may impair working capacity. Work-related musculoskeletal disorders are defined as disorders and diseases of the musculoskeletal system, which have been proven or assumed to have at least a partly work-related background (WHO, 2010). These disorders constitute a heterogeneous group, but it is still possible to identify some generic work risk factors, e.g. repetitive or force-demanding tasks, awkward postures, features of workplace design, cognitive demands, as well as organizational arrangements and psychosocial factors (Seppala 2001).
2.3 AWARENESS OF PAIN SYMPTOMS ASSOCIATED WITH WORK RELATED MUSCULOSKELETAL DISORDERS

Anaclaudia Gastal Fassa et al (2005) conducted an epidemiologic survey assessed the prevalence of musculoskeletal disorders in several anatomic sites in children aged 10–17. The study found an increased risk of musculoskeletal pain and back pain among children working in manufacturing and domestic services when compared with non workers and workers in retail. The exposure to awkward posture and heavy physical work increased the risk of musculoskeletal pain and were important intermediate variables in the association between work activity and this outcome. Awkward posture, monotonous work, and noise increased the risk of back pain and were important mediators in the association between work activity and back pain.

Danielle, et al (2000) analyzed the occupational risk factors of shoulder pain. 29 Studies were included in the review; three case-control studies and 26 cross sectional designs. The median method score was 60% of the maximum attainable score. Potential risk factors related to physical load and included heavy work load, awkward postures, repetitive movements, vibration, and duration of employment. Consistent findings were found for repetitive movements, vibration, and duration of employment (odds ratio (OR) 1.4–46 in studies with method scores ≥ 60%). Nearly all studies that assessed psychosocial risk factors reported at least one positive association with shoulder pain, but the results were not consistent across studies for either high psychological demands, poor control at work, poor social support, or job dissatisfaction. Studies with a method score ≥60% reported ORs between 1.3 and 4.0. Substantial heterogeneity across studies for methods used for exposure assessment and data analysis impeded statistical pooling of results,
shoulder pain is the result of many factors, including physical load and the psychosocial work environment.

Van der Windt (2000) in their study it was revealed the prevalence of 12-month shoulder pain varied from 6-40% in different working populations. The study consisting of 7,217 adults (aged ≥ 30 years) about 30% reported having had shoulder pain during the previous month. The risk factors for shoulder pain were related to heavy physical workload, awkward postures and long work experience, repetitive movements and duration of employment were associated with of shoulder pain.

In a study conducted by Punnett et al (2000), it was found that relationship was existed between shoulder disorders and severe upper arm flexion or abduction (>90 degrees). As the number of work cycles with awkward postures (duration of severe flexion or abduction is 10% or more of the work cycle) increased, also the risk of shoulder disorders increased.

In the Health study conducted by Zecevic et al (2000), the study revealed the prevalence of 1-month low-back pain was about 36% among the women and 30% among the men (persons aged ≥30 years). There was strong evidence that work-related risk factors, namely lifting, heavy physical work and bending or twisting the back were associated with an increased risk for low-back pain. Psychosocial factors and mental stress were related to low back pain and affect the reporting of back injuries. The evidence for individual factors such as height, weight, smoking, physical fitness, trunk muscle performance and mobility were less consistent with regard to non-specific low back pain.

Vingard et al (2000) in his study revealed the current and past physical and psychosocial occupational factors were associated with care seeking for low back pain in working men and women. The study comprised
2118 working men and women 20 to 59 years old (695 cases and 1423 referents). The exposure assessments were made through questionnaires and interviews about current and past physical and psychosocial loads during work and leisure time. In a logistic regression analysis, physical load from forward bending in men (RR = 1.8) and high physical load, in general, in women (RR = 2.0) showed increased relative risks. Psychosocial factors alone seemed to be of less importance in women, but "poor job satisfaction" and "mostly routine work without possibilities of learning" increased the risk in men. Combined current and past exposures further increased the risks.

Fallentin et al (2001) conducted a study among four hundred eighty five patients whose chief complaints were work related pain and other symptoms to determine the extent of their illness. The group had a mean age of 38.5 years. Sixty-three percent of patients were females. Seventy percent were computer users, 28% were musicians and 2% were others engaged in repetitive work. The time between the onset of symptoms and our initial visit ranged from 2 weeks to over 17 years. A majority sought care within 30 months with the greatest number of them seeking care before 12 months. Fifty nine percent of subjects were still working when seen despite increasing pain and symptoms such as weakness, numbness, tingling and stiffness. Significant findings included postural misalignment with protracted shoulders (78%), head forward position (71%) and complex regional pain syndrome (RSD) (0.6%). Hyper laxity of fingers and elbows was found in over 50%, carpal tunnel syndrome in 8%, radial tunnel syndrome in 7%, cubital tunnel in 64%, shoulder impingement in 13%, medial epicondylitis in 60%, lateral epicondylitis in 33% and peripheral muscle weakness in 70%. It was concluded that work-related upper-extremity disorders were a diffuse neuromuscular illness with significant proximal upper-body findings that affect distal function.
Viikari Juntura et al (2001) conducted a study to find the impact of psychosocial factors on the computer use factors in the development of musculoskeletal disorders in the computing workplace. A questionnaire-based study was undertaken to test this hypothesis in a sample of 67 call centre workers. It was found that overall; computer use factors were significantly associated with self-reporting of musculoskeletal disorder symptoms, whereas psychosocial factors had no such association. However, certain individual psychosocial factors emerged as having a significant association with musculoskeletal disorder symptoms. The findings suggest that specific areas of call centre work have associations with poor worker health and possible long-term musculoskeletal disorder problems. These areas appear to be workload and particular management-worker relations, rather than computer use.

Hansson and Westerholm (2001) investigated the prevalence of musculoskeletal disorders and trends with psychosocial risks, across age and gender. The study group consisted of 200 female and 132 male employees from varied occupations within Ireland, ranging from age 18-66 years. The most prevalent symptoms of musculoskeletal disorders were for the lower back, shoulder and neck regions. The prevalence of age and gender differences was evident for these regions. There was a general trend for increasing prevalence with age. For the psychosocial risks, significant differences in job content exposures were observed across age groups for males (p < 0.05) and females (p < 0.0005). There were also differences in scores across the age groups for mental health (p < 0.0005) and insecurity at work (p < 0.0005) for the females. It was concluded that there were no sufficiently strong differences in exposures to relevant psychosocial risks both between genders and across age for a resultant effect on musculoskeletal disorders.
Yeung et al (2002) in his study found out musculoskeletal symptoms are prevalent in different and multiple body regions among manual handling workers and to determine whether a simple index (i.e., perceived risk of lifting injury) evaluated by the worker is significantly associated with musculoskeletal outcomes in single and multiple body regions. Lower back symptoms were the most frequent among manual handling workers, followed by the shoulders, then the upper back, hips-upper legs and neck. Finger symptoms had the lowest prevalence values. Musculoskeletal symptoms for multiple body parts (two or more) were more prevalent (64% of all workers) than those for single body regions (19%). Approximately 85% of lower back symptoms were associated with disorders in other body regions. Multivariate analyses indicated that the effects of perceived risk were significant for eight body regions and that age was significant for three of them. Perceived risk of lifting injury also was significant for multiple body regions.

Holmberg et al (2002) in their study reported more symptoms significantly affecting the hands and forearms, low back and hips than did the non-farmers and a non-significant trend in the same direction was found for symptoms from the neck, shoulders and knees. However, the farmers did not seek medical advice and they reported significantly less sick leave for these problems. Thus, farmers appear to have more musculoskeletal symptoms than do non-farmers.

Smith et al (2003a) conducted an epidemiological investigation of musculoskeletal disorders among a complete cohort of 222 female nursing students in Yamanashi prefecture, central Japan. This study involved a retrospective analysis of data gathered by means of a self-reported, anonymous questionnaire. Symptom descriptions and evaluation criteria were drawn from previously validated studies. Slightly more than one-third of all nursing students (36.9%) reported a current musculoskeletal disorder at some
body site. By location, shoulder musculoskeletal disorder was the most common condition; affecting 14.9% of them. This was followed by musculoskeletal disorder of the lower back (13.5%), neck (9.5%), knee (5.0%), forearm (2.7%), legs (2.3%) and feet (1.8%). Headache was also reported by 4.5%. There were no statistically significant differences between musculoskeletal disorder prevalence and year of study in the nursing course. However, previous hospital work was found to increase the risk of shoulder musculoskeletal disorder by a factor of 4.4 among the students within this study.

Trinkoff et al (2003) in their study found that nurses with mechanical lifting devices available were significantly less likely to have neck or back musculoskeletal disorders. Back injury was less likely, when lifting teams were available. However, adjustable beds and transfer sheets were associated with greater odds of back musculoskeletal disorder. Training in workstation adjustment was associated with significantly lower musculoskeletal disorder prevalence, though postural training was not.

Wahlstrom et al (2003) investigated whether perceived muscular tension, psychological demands and emotional stress were associated with physical load or working technique during visual display unit (VDU) work. Subjects (28 women and 29 men) from two different organizations volunteered to participate in the study. High emotional stress during the measurement was associated with higher muscle activity in the trapezius muscle on the side not operating the computer mouse. Subjects who reported high levels of emotional stress worked more often with lifted shoulders. However, when present musculoskeletal pain was included in the multivariate model the odds ratio for high emotional stress decreased to 4.5. Perceived muscular tension and emotional stress were associated with physical load, in
terms of muscle activity in the trapezius muscles, during VDU work in ordinary occupational settings.

Trinkoff et al (2003) examined the relationship between perceived physical demands and reported neck, shoulder and back musculoskeletal disorders in nurses. Data were collected anonymously from 1163 randomly selected working nurses (74% response rate) using a cross-sectional survey. The 12-item survey scale (internal reliability coefficient=0.89), rated perceived physical demands such as force, awkward postures and heavy lifting. Nurses with a presumed musculoskeletal disorder case reported relevant past year symptoms in the neck, shoulder and/or back lasting >=1 weeks or at least monthly, with moderate or more pain, on average. Moderate and high perceived physical demands were significantly associated with reported neck, shoulder and back musculoskeletal disorder cases, even after adjustments for demographic and lifestyle-related covariates. Adjusted odds ratios for highly demanding work ranged from 4.98 to 6.13 depending on body site.

Smith et al (2003b) investigated the prevalence of musculoskeletal disorders among a previously understudied group of Asian nursing professionals in a rural setting. A total of 305 female nurses (84% response rate) were recruited from a university teaching hospital in Yamanashi prefecture, central Japan. Data were gathered by means of a self reporting questionnaire. Lower back pain (LBP) was the most commonly reported musculoskeletal disorder, affecting 59% of all nurses. This was followed by musculoskeletal disorder of the shoulder (46.6%), neck (27.9%), knees (16.4%) and upper leg (11.8%). Working in the surgical department was shown to increase the risk of any musculoskeletal disorder 2.7 times when compared to nurses in the other departments (odds ratio 2.7, 95% confidence interval 1.2-6.7, P = 0.0202). Overall, our study shows that musculoskeletal
disorders are reasonably common among registered nurses in a rural Japanese hospital. These staff was found to be at greater risk of suffering musculoskeletal disorder than their city-based nursing counterparts and foreign colleagues, particularly with respect to low back pain.

Pinzke (2003) analysed the changes in working conditions and health among dairy farmers in Scania in southern Sweden by a repeat of a mail-in survey. Altogether, 83% of the male and 90% of the female dairy farmers reported some kind of symptoms in the musculoskeletal system during the 12 months prior to the 2002 questionnaire. The highest significant changes were an increase of symptoms in the shoulder, neck and in the wrists/hands. The milkers reported most often incidental as well as persistent symptoms in the shoulders. The frequency of hip symptoms was significantly higher among those male milkers who had quit milking during the interim than for the active milkers. The milkers studied in 2002 had, on average, increased their working time per week, increased the number of cows milked as well as the use of more milking units.

Davey (2003) in their study examined musculoskeletal disorder and their after-effects among 334 health professionals in Beijing, by means of an anonymous questionnaire (response rate: 99.4%). Of the respondents, 92.2% reported an musculoskeletal disorder occurring in the previous 12 months, with the neck (72.2%), shoulder and lower back (59.9% each) being the most commonly affected body sites. Fifty-six percent of all musculoskeletal disorder had persisted > 24 hours, 23.0% had interfered with their work ability and 15.9% required medical treatment. Musculoskeletal disorder of the hand/wrist and musculoskeletal disorder of the shoulders were the most likely to last > 24 hours. Musculoskeletal disorder of the lower back, upper legs or hand/wrist was all associated with a reduction of work ability. Medical treatment was more likely to have been sought for musculoskeletal disorder of
the lower back or knees, when compared to other body sites. Females were five times more likely to report musculoskeletal disorder at anybody site, while tobacco smokers were three times more likely to have sought medical treatment for musculoskeletal disorder. Overall, this study suggested that musculoskeletal disorder were becoming an increasingly important cause of functional disability among white-collar workers in China.

Smith et al (2003c) investigated the prevalence and correlates of musculoskeletal disorder among nurses within an affiliated hospital conglomerate of rural Japan. An initial group of 329 nurses was recruited from three affiliated, rural locations in Yamanashi prefecture, central Japan; 247 usable replies were obtained (final response rate: 75.1%). The 12-month period-prevalence of self-reported musculoskeletal disorder at anybody site was 91.9%. Low back pain (LBP) was the most commonly reported musculoskeletal disorder with a prevalence of 82.6%. Next most reported were shoulder, neck, upper back, knee and upper leg musculoskeletal disorder of the wrist, upper arm and lower arm were less common. Logistic regression indicated that nurses who were regularly involved in the manual handling of patients had an increased LBP risk of 16.7 when compared with nurses who were not involved in manual handling of patients.

Smith (2004) investigated 180 nurses (84.1 percent response rate) from a teaching hospital in Shijiazhuang, Hebei Province, using a previously validated, self-reporting musculoskeletal disorder survey. The overall prevalence of musculoskeletal disorders was 70.0 percent, with individual categories reported as follows: lower back (56.7 percent), neck (42.8 percent), shoulders (38.9 percent) and upper back (38.9 percent). Period pain was shown to increase the risk of musculoskeletal disorders 23.8 times. Excessive mental pressure incurred a 10.5-fold risk increase. Interestingly, occasional
consumption of alcoholic drinks reduced the risk of musculoskeletal disorders 10-fold as did working in the gynecology department.

Smith and Leggat (2004) investigated the prevalence of musculoskeletal disorders among rural Australian nursing students and compared the results with other international studies. A self-reporting questionnaire was adapted from previous research. 260 students from all three grades of a major nursing school in regional north Queensland, Australia participated in the study. A high proportion of students reported an musculoskeletal disorder at some body site (80.0%), with low back pain being the most common condition (59.2%). This was followed by musculoskeletal disorder of the neck (34.6%), knee (25.0%), shoulder (23.8%), feet (16.5%), wrist (12.7%) and legs (11.9%). musculoskeletal disorder of the shoulder was slightly more common among males when compared to females (39.3% vs 22.0%, P = 0.0424). Previous paid employment as a nurse or nursing assistant was found to increase the risk of upper arm musculoskeletal disorder by a factor of 10.8. Overall, this investigation suggested that musculoskeletal disorder was more frequent among rural Australian nursing students, when compared to their counterparts around the world. Their high rate of musculoskeletal disorder was also comparable to that reported by hospital nurses in other countries.

Alexopoulos (2004) investigated the relations between physical, psychosocial and individual characteristics and different endpoints of musculoskeletal complaints of low back, neck, shoulders and hand/wrist. A questionnaire survey was carried out among 430 dentists (response 88%) in Thessaloniki, Greece. 62% of dentists reported at least one musculoskeletal complaint, 30% chronic complaints, 16% had spells of absence and, 32% sought medical care. Self-reported factors of physical load were associated with the occurrence of back pain (OR = 1.59), shoulder pain and, hand/wrist
pain. With the exception of hand/wrist complaints, the physical factors were not associated with chronic complaints and musculoskeletal sickness absence. Physical load showed a trend with the number of musculoskeletal complaints with ORs of 2.50, 3.07 and 4.40 for two, three and four musculoskeletal complaints, respectively. No consistent influence of psychosocial factors on complaints, chronicity, sickness absence and medical care seeking was observed. A perceived moderate general health was a significant factor for chronic complaints, co morbidity and medical care seeking where high perceived exertion was significant for absenteeism. Living alone was also related with increased absenteeism due to shoulder pain and hand/wrist.

Van Duijnhoven (2005) measured interrelationships among pain, functional disability, general health and overall quality of life for workers on sickness absence for 2 to 6 weeks due to musculoskeletal complaints and assessed the impact of work-related and individual characteristics on these different health dimensions. A total of 218 workers on sickness absence for 2 to 6 weeks due to musculoskeletal complaints completed a questionnaire on four different health dimensions and work-related and environmental factors. Moderate correlations ($r < 0.50$) among measures of pain, disability, general health and quality of life were found. These health dimensions were not influenced by work-related physical and psychosocial workload, suggesting no impact of recall bias in studies for work-related musculoskeletal complaints. Self-perceived ability to return to work within 6 weeks explained 21% to 26% of the outcomes on pain and disability and contributed less to the generic measures of health.

Smith et al (2005) investigated the prevalence and distribution of musculoskeletal disorders among Chinese medical students, by means of a questionnaire survey. A total of 207 questionnaires were successfully returned, giving a high response rate of 92.4%. The musculoskeletal disorder
period-prevalence at any body site was 67.6% in the previous year and 46.9% in the previous week. Almost one-third of them (31.9%) reported an ongoing musculoskeletal disorder. By individual body site, the most commonly affected region was the lower back (40.1% in the last year), followed by the neck (33.8%) and shoulders (21.7%). The 7 day period-prevalence also followed a similar descending pattern, being reported by 20.8% at the lower back and 12.1% at both the neck and knees. Musculoskeletal disorder affected the daily life of students for an average period of 53.8 days, with an average of 6.6 sick days taken from school. Students reporting high mental pressure were 2.9 times more likely to suffer low back pain in the previous 12 months (OR 2.9, 95%CI 1.4-5.9, P=0.0030). Overall, the study suggested that Chinese medical students are at reasonable musculoskeletal disorder risk, although it is probably lower than for working physicians.

Stal and Englund (2005) carried out a cross-section postal questionnaire survey dealing with musculoskeletal symptoms among female and male pig farmers in large-scale production. The participation rate overall was 70% (288/410). Three different questionnaires were used: the general standardized Nordic questionnaire for the analysis of musculoskeletal symptoms; a questionnaire dealing with occurrence of numbness, reduced muscle strength, etc., in the wrists and hands; and occupational factors were screened by a special questionnaire. The results showed that musculoskeletal morbidity is high among pig farmers. The women had significantly more problems than the men with respect to the upper extremities. Symptoms in the wrists and hands such as numbness, reduced muscle strength, aching fingers and wrists and tendency to drop things were significantly more common among the women than the men.
Harkness et al (2005) examined the difference in the prevalence of low back, shoulder and widespread pain between the 1950s and today using historical data collected by the Arthritis Research Campaign (ARC). Two cross-sectional surveys conducted over 40 year apart in the northwest region of England. Subjects were classified positively if they reported low back pain, shoulder pain or widespread pain on the day of the survey. There were large differences in the prevalence of musculoskeletal pain between the two surveys. For all three symptoms examined prevalence increased from 2- to 4-fold between the two surveys. In both surveys low back pain was more common in women. Shoulder and widespread pain was less prevalent in women than in men in the earlier survey but by the time of the later survey women reported more pain at these sites. The prevalence of musculoskeletal pain was much higher than that reported over 40 year ago.

Rosecrance et al (2006) determined the prevalence of low back pain and other musculoskeletal disorders among the farmers and examined the factors associated with occupational back pain. Farmers in a predominately corn and soybean growing region of Kansas served as the study sample. The participation rate was 57.2%. The low back was the anatomical area with the highest prevalence of self-reported work-related pain (37.5%), followed by the shoulders (25.9%), knees (23.6%) and neck (22.4%). Close to 60% of the farmers reported that they experienced farm work-related musculoskeletal disorder symptoms in at least one of the nine body parts in the previous year. Nearly one quarter of the farmers reported seeing a physician for their low back symptoms and one in five farmers had to modify their work habits due to low back symptoms during the previous year. The findings concluded low back pain and other musculoskeletal conditions as significant problem for Kansas farmers. This group of Kansas farmers experienced low back pain at a much higher rate than the general working population.
Alexopoulos (2003) analysed cross-cultural differences between Greek and Dutch nursing personnel in association with the risk factors and occurrence and consequences (absenteeism and medical care seeking) of musculoskeletal disorders. 393 nurses and caregivers in nursing homes and homes for the elderly in The Netherlands and 351 nurses in general hospitals in Athens, Greece were the sample of the study. Greek nurses reported significantly more back complaints in the past 12 months (75 vs. 62%) than the Dutch workers, but chronicity (11 vs. 12%) and sickness absence (17 vs. 15%) of these complaints did not differ. Similar differences were observed for neck complaints but not for shoulder complaints. Most Greek nurses with back complaints visited a medical specialist (40%) while Dutch nurses and caregivers sought care through a general practitioner (33%). Multivariate analyses showed that in both countries strenuous back postures and especially a moderate general health were the significant risk factors for back pain.

Alexopoulos (2006) conducted a study among 853 shipyard employees. Data were collected by questionnaire on physical and psychosocial workload, need for recovery, perceived general health, occurrence of musculoskeletal complaints and health care use during the past year. In total, 37%, 22% and 15% of employees reported complaints of low back, shoulder/neck and hand/wrist during the past 12 months, respectively. Among all employees with at least one musculoskeletal disorder, 27% visited a physician at least once and 20% took at least one period of sick leave. Various individual and work-related factors were associated with the occurrence of musculoskeletal disorder. Health care use and absenteeism were strongly influenced by chronicity of musculoskeletal complaints and comorbidity with other musculoskeletal complaints and, to a lesser extent, by work-related factors.
Fiona Macdonald and Eugene Waclawski (2006) investigated the prevalence of upper limb disorders among 108 coopers and 110 non-coopers. The Standardized Nordic questionnaire for the analysis of musculoskeletal symptoms was administered to all participants. Coopers were more likely to report elbow pain in the past 12 months (OR 3.4; 95% CI: 1.8-6.2) and pain in the last 7 days (OR 4.7; 95% CI: 2.0-8.9) and this was likely to lead to prevention of activity in the past 12 months associated with the elbow (P < 0.05). Clinical evaluation highlighted a higher prevalence of upper limb disorders in coopers (OR 9.8; 95% CI: 3.9-24.3) with epicondylitis predominating (OR 8.4; 95% CI: 2.8-25.0). There was also a higher prevalence of problems in the wrist and hand among coopers (OR 8.15; 95% CI: 1.04-64; P = 0.03). Logistic regression analysis confirmed the risk of upper limb disorder in coopers (P < 0.03) accounting for age (P < 0.05) and years of service (P > 0.25).

Ye., et al (2007) carried out a survey among 3070 workers aged 18 to 67 years (mean, 39.9 years) at a prefectural administrative office, in which 76% of subjects were visual display terminal (VDT) users. The relationship between duration of daily VDT use and eyestrain, neck or upper extremity pain, back pain and mental health and estimated the effect of breaks and rest during VDT work on these symptoms were examined. Seventeen percent of subjects reported eyestrain, 19.1% reported upper extremity pain and 11.6% reported back pain and 17% of subjects had GHQ-12 scores of 4 or higher. Logistic regression analysis showed that duration of daily VDT use and lack of breaks and rest during VDT work were significantly associated with eyestrain, neck or upper extremity pain, back pain and psychological distress. In order to protect users from the adverse effects associated with VDT work, reducing daily VDT exposure, taking breaks and rest during VDT work were found to be important.
Walsh (2008) evaluated musculoskeletal disorders among active industrial workers. One hundred and thirty-four female workers answered questions about their physical symptoms, filled out a pain scale and gave responses in the Oswestry Disability Questionnaire and the Work Ability Index questionnaire. The work ability index presented a negative correlation with the physical disability index. Symptoms reported at the time of the assessment presented a good correlation with the results from the pain scale and the clinical findings. Previous sick leave showed an association with disability.

2.4 GENDER AND MUSCULOSKELETAL DISORDERS

Wahlstrom et al (2000) investigated whether gender or different methods of operating a computer mouse have an effect on performance and musculoskeletal load in the use of a computer mouse. Thirty experienced computer mouse users, 15 men and 15 women, participated in the study. The women worked with greater extension and range of motion and tended to work with a greater ulnae deviation of the wrist. They also applied higher forces to the mouse when expressed as a percentage of a maximum voluntary contraction and had higher muscular activity in the right extensor digit rum. Gender differences were found for musculoskeletal load and for most of the measured variables the women worked with higher loads than the men. The work method affected performance and musculoskeletal load. Finally, subjective measures appeared to have some utility in characterizing muscular load.

Miranda et al (2001) in their study among newspaper employees revealed that the risk of shoulder pain was more than twice as high for the women than for the men. Other individual factors associated with shoulder pain were age and body mass index.
Pinheiro (2002) in their study validated the Portuguese version of the Nordic Musculoskeletal Questionnaire (NMQ) and evaluated the relationship between musculoskeletal morbidity and demographic, occupational and behavior variables. Ninety government bank employees were interviewed using the Portuguese version of NMQ in Brasilia, Brazil, in 1999. The results revealed an 86% agreement rate between symptoms reported in the NMQ and the respondent's clinical history. There were found differences in symptoms prevalence for the variables gender, occupation and physical activity. Women showed a higher severity average of symptoms for almost all body anatomical regions; managers reported greater severity of symptoms in the lumbar area than clerks; physical activity was associated to the lowest severity of symptoms in upper extremities. The results showed that the Portuguese NMQ version includes a good validity indicator and is satisfactory as a musculoskeletal morbidity measurement tool. However, there is a need of more items to measure the severity of symptoms; and changes in scale layout in order to make it more easily understandable and less prone to avoidable missing data.

Lindegard et al (2003) investigated the possible associations between working technique, sex, symptoms and level of physical load in VDU-work. A study group of 32 employees in the editing department of a daily newspaper answered a questionnaire, about physical working conditions and symptoms from the neck and the upper extremities. The results showed that subjects classified as having a good working technique worked with less muscular load in the forearm (extensor carpi ulnaris p=0.03) and in the trapezius muscle on the mouse operating side (p=0.02) compared to subjects classified as having a poor working technique. Moreover there were no differences in gap frequency (number of episodes when muscle activity is below 2.5% of a reference contraction) or muscular rest (total duration of gaps) between the two working technique groups. Women in this study used
more force (mean force p=0.006, peak force p=0.02) expressed as % MVC than the men when operating the computer mouse. No major differences were shown in muscular load, wrist postures, perceived exertion or perceived comfort between men and women or between cases and symptom free subjects. In conclusion a good working technique was associated with reduced muscular load in the forearm muscles and in the trapeziums muscle on the mouse operating side. Moreover women used more force (mean force and peak force) than men when operating the click button (left button) of the computer mouse.

2.5 AWARENESS OF RISK FACTORS AND CONSEQUENCES OF MUSCULOSKELETAL DISORDERS

In Visual Display Unit work, the muscular activity of the neck and shoulders resists the gravity acting on the forward flexed head while the worker views the screen. The bones and joints of the upper limb have to be stabilized by the muscles to enable exact movements of the fingers and hands. If there is no mechanical support for the forearm, the shoulder muscles must hold the weight of the whole upper limb and this further increases muscle tension (McDonald 2000).

Aaras, A., et al (2001), conducted an epidemiological study covering parallel group design with two intervention groups (T and S) and one control group (C) of Visual Display Unit (VDU) operators covers the period from 2 to 6 years of the study. After 3.5 years, the C group got the same intervention in terms of new lighting system, new workplaces. The C group reported a significant reduction in visual discomfort after interventions while the two groups (T and S) continued to report significant reduction of visual discomfort after 6 years. By supporting the forearm on the table top, the C group reported significant reduction of shoulder and neck pain while the T group reported significant reduction in shoulder and back pain after 6 years.
Organizational and psychosocial factors at work and outside work did not show any significant changes during the study period.

Aaras et al (2000) in their study revealed that in VDU work, visual information was presented on a screen and the information was handled by manual input devices like the keyboard and mouse. All the equipment was stable in the same position on the table and the worker was therefore required to keep the same static posture while working. Concentrating on the work may prevent the worker from becoming aware of early signals of fatigue.

Burdorf et al (2005) analysed the cross-cultural differences between Greek and Dutch nursing personnel in association with the risk factors and occurrence and consequences of musculoskeletal disorders. The study was based on questionnaire surveys among 393 nurses and caregivers in nursing homes and homes for the elderly in the Netherlands and among 351 nurses in general hospitals in Athens, Greece. Logistic regression analysis was used to analyse associations between physical and psychosocial workload, need for recovery, perceived general health and (1) the occurrence of musculoskeletal complaints in the past 12 months, (2) chronic complaints during at least 3 months, and (3) complaints which led to sickness absence and medical care seeking. Greek nurses reported significantly more back complaints in the past 12 months (75 vs. 62%) than the Dutch workers, but chronicity (11 vs. 12%) and sickness absence (17 vs. 15%) of these complaints did not differ. Similar differences were observed for neck complaints but not for shoulder complaints. Most Greek nurses with back complaints visited a medical specialist (40%) while Dutch nurses and caregivers sought care through a general practitioner (33%). Multivariate analyses showed that in both countries strenuous back postures (ORs 1.9 and 1.9) and especially a moderate general health (ORs 4.3 and 2.9) were the significant risk factors for back pain.
Hagberg (2002) conducted an epidemiological study of the effects of vibration on the musculoskeletal system of the upper limbs. Low-frequency vibration exposure of high magnitude was associated with osteoarthritis in the elbow, wrist and acromioclavicular joint and symptoms in the elbow and shoulder. Impacts, jerks and blows with high-energy transfer to the hands at low frequency might have the potential to result in musculoskeletal disorders considering the general model for injuries. Furthermore, the observed associations with vibration exposure and musculoskeletal disorders might result from the strong dynamic and static joint loading and the repetitive hand-arm motions required in tasks where hand-held machines are used. The clinical assessment of musculoskeletal disorders in workers exposed to hand-arm vibration consists of the clinical and exposure history and evaluation of the physical and laboratory findings. Since most patients with musculoskeletal disorders who are exposed to vibration are also exposed to other ergonomic stressors, accommodation of the injured worker has to take the whole work system into account (task, technology, environment and organisation). The vibrating machines are associated with musculoskeletal disorders.

According to Sjøgaard et al (2000), insufficient recovery after local muscle fatigue was believed to be essential in the genesis of muscular pain in static work. The time spent with computers has been shown to be associated with discomfort especially in the neck shoulder area. Psychosocial factors are important in both the development and persistence of shoulder problems. Job dissatisfaction, high psychosocial demands and a poor social work environment, together with a poor personal capacity to cope with these factors, may increase work-related stress. Stress may cause a higher level of muscle tone and strengthen the relation between physical load and shoulder symptoms.
A combination of the risk factors (force and repetition, force and posture) has been found in the reviews to be strongly associated with carpal tunnel syndrome. There is also evidence that repetition and force separately are related to the carpal tunnel syndrome. Investigating the effect of vibration alone is difficult, since it is usually associated with the use of handheld vibrating tools, the use of hand force and non neutral postures.

Palmer et al (2000) found that low frequency impact vibration was transmitted to the elbows and shoulders and had an effect on those areas, whereas high-frequency impact vibration transmitted to the hand and wrist may predominantly cause symptoms there. This shows that there is a clear association between a high level of exposure to vibration and the hand-arm vibration syndrome.

Furthermore, Simoneau and Marklin (2001) showed that hand-arm vibration activates the sympathetic nervous system and induces vasoconstriction in the feet even though they are not directly exposed to vibration.

2.6 AWARENESS OF WORK RELATED MUSCULOSKELETAL DISORDER SYMPTOMS AMONG LIBRARY PROFESSIONALS.

A cross sectional study by Hakkanen and Viikari juntura (2001) demonstrates a link between repetitive work and tendinitis. Of the individual factors, a higher risk of hand-wrist disorders has been found among women and newly employed workers. The presence of psychosomatic problems has also been shown to be a strong predictor of wrist tendinitis.

Abe, M., and Yamada, N., (2001) conducted a study to determine whether the kinematic pattern generation of upright posture is influenced by a
change in the swinging frequency of arm movements and whether the pattern generation is correlated with a change in joint torque about the shoulder joint. The results of kinetic analysis revealed that changes in the joint torque patterns about the shoulder and hip joints occurred in trials at 40-45%max. The mean value of 40-45%max was close to the Eigen frequency of each subject's arm.

Psihogios et al (2001) showed that muscle tension increases even more if the worker performs the task in a non-neutral posture. It has been shown that computer use in sustained non-neutral neck or shoulder postures, such as rotated neck or the abducted shoulder is a risk factor for neck pain. It has also been shown that visual discomfort and musculoskeletal strain, particularly in the neck and shoulders, are associated with computer screen height.

Fries Svensson and Svensson (2001) revealed that a higher monitor placement was associated with strenuous neck extension caused by visual demands. On the other hand, an extreme low location was often associated with musculoskeletal stress caused by neck flexion. However, the benefit of a lower placement was reduced of eye irritation, as the open surface of the eyes was smaller and lacrymation was better. Finally, the results of a field study supported the midlevel (~20° viewing angle) placement of the screen.

Hagberg (2002) revealed that a cold environment and local mechanical pressure can increase the risk for the carpal tunnel syndrome. Individual factors such as female gender, obesity and older age have been found to increase the risk for the syndrome.

Pain in the upper limbs is a problem in the industrialized countries. According to Takala (2002), the most common occupational disease group (for which compensation is paid by an insurance company) is the repetitive
strain injury of the upper limb. In their study, the incidence rate was 6.3 cases per 10,000 employed workers. The highest incidence rate was found in the food-processing industry, where 94 cases per 10,000 employed workers were reported. Physical risk factors that have been found to have an association with upper limb disorders are high demands of force, repetitive movements, non-neutral postures, cold temperature and hand-arm vibration. Especially combinations of these risk factors have been associated with upper limb disorders.

In a prospective study Gerr et al (2002) showed that for over 50% of the study participants who used computers for over 15 hours per week reported musculoskeletal symptoms in their first year in a new job.

Jensen et al (2002) found that workers, who used a computer almost all the time at work, reported more repetitive movements than those who used it less. Jensen hypothesized that the repeated hand movements when using the keyboard and mouse could explain the association between the symptoms and time spent in computer work.

Devereux et al (2002) investigated potential interactions between physical and psychosocial risk factors in the workplace that may be associated with symptoms of musculoskeletal disorder of the neck and upper limb. 891 of 1514 manual handlers, delivery drivers, technicians, customer services computer operators and general office staff reported on physical and psychosocial working conditions and symptoms of neck and upper limb disorders using a self administered questionnaire (59% return rate). Of the 869 valid questionnaire respondents, 564 workers were classified in to one of four exposure groups: high physical and high psychosocial, high physical and low psychosocial, low physical and high psychosocial and low physical and low psychosocial. Low physical and low psychosocial was used as an internal reference group. In the multivariate analyses, the highest and significant
increase in risk was found in the high physical and high psychosocial exposure group for symptoms of hand or wrist and upper limb disorders after adjusting for years at the job, age and sex. A potential interaction effect was found for the symptoms of the hand or wrist and upper limb disorders but not for the neck symptoms. This study showed that workers highly exposed to both physical and psychosocial workplace risk factors were more likely to report symptoms of musculoskeletal disorders than workers highly exposed to one or the other. The results suggest an interaction between physical and psychosocial risk factors in the workplace that increased the risk of reporting symptoms in the upper limbs.

According to Bongers et al (2002) high job demands and low job control, low decision latitude and low social support were found to be related to upper limb disorders.

Smith (2004) assessed the prevalence of and risk factors for, musculoskeletal complaints among hospital nurses in mainland China. A total of 282 female, registered nurses were surveyed (92% response rate) using a modified Chinese-language version of the Standardized Nordic Questionnaire. The 12 month period-prevalence of musculoskeletal complaints at any of the four regions was 70%. The lower back was the most commonly reported body site (56%), followed by the neck (45%), shoulder (40%) and upper back (37%). High mental pressure, boring or tedious tasks and limited work support were identified as significant risk factors. No correlations were found between manual handling or perceived physical exertion and increased reporting of musculoskeletal complaints.

Smith (2006) conducted a study on musculoskeletal disorder risk factors among Japanese nurses. 1,162 nurses from a large teaching hospital participated in the study. Musculoskeletal disorder categories focused were on the neck, shoulder, upper back and lower back regions. Musculoskeletal
disorder was most commonly reported at the shoulder (71.9%), followed by the lower back (71.3%), neck (54.7%) and upper back (33.9%). Alcohol consumption, tobacco smoking and having children were shown to be significant risk factors, with adjusted Odds Ratios of 1.87, 2.45 and 2.53 respectively. Workplace risk factors included manually handling patients and undertaking physically laborious work. Nurses reporting pre-menstrual tension were 1.66 and 1.94 times more likely to suffer from lower back and upper back musculoskeletal disorder, respectively. High mental pressure was also identified as a significant risk factor for musculoskeletal disorder of the neck and shoulder.

Bos et al (2007) determined the relation between physical and psychosocial work-related risk factors and the complaints mentioned in non-specialized nurses, operation room nurses, Intensive Care (IC) nurses and X-ray technologists. The study population consisted of 3,169 employees affiliated to eight university hospitals in the Netherlands. In all groups prevalence rates of musculoskeletal complaints were high: low back 76%, neck-shoulder 60%. Operation room nurses perceived more neck-shoulder complaints (12 months prevalence) than non-specialized nurses and IC nurses perceived less severe low back complaints than non-specialized nurses. Four physical risk factors and one psychosocial factor were associated with low back complaints in all groups. The results of the present study indicate that both low back complaints and neck-shoulder complaints were major health problems in the four professional groups under study. The prevalence rate of neck-shoulder complaints in operation room nurses was higher than in non-specialized nurses and IC nurses, the latter groups having high prevalence rates already. The exposure to risk factors was perceived differently by each of the professional groups.
2.7 INFLUENCE OF WORK RELATED MUSCULOSKELETAL DISORDERS ON SICKNESS ABSENCE

Derek, R., Smith, et al (2005) investigated the prevalence and distribution of Musculoskeletal Disorders among Chinese medical students, by means of a questionnaire survey. A total of 207 questionnaires were successfully returned, giving a high response rate of 92.4%. The MSD period-prevalence at any body site was 67.6% in the previous year and 46.9% in the previous week. Almost one-third of them (31.9%), reported an ongoing MSD. By individual body site, the most commonly affected region was the lower back (40.1% in the last year), followed by the neck (33.8%) and shoulders (21.7%). The 7 day period-prevalence also followed a similar descending pattern, being reported by 20.8% at the lower back and 12.1% at both the neck and knees. MSD affected the daily life of students for an average period of 53.8 days, with an average of 6.6 sick days taken from school. Students reporting high mental pressure were 2.9 times more likely to suffer low back pain in the previous 12 months (OR 2.9, 95%CI 1.4-5.9, P=0.0030). The study suggests that Chinese medical students are at reasonable MSD risk, although it is probably lower than for working physicians. Further investigations are now recommended to elucidate the MSD mechanisms and contributory factors among medical students in China, as elsewhere. A longitudinal study of MSD among a complete group of medical students would be very useful in this regard.

Izelenberg et al (2004) investigated whether individual, work-related physical and psychosocial risk factors involved in the occurrence of musculoskeletal complaints also determine musculoskeletal sickness absence. This cross-sectional study used a self-administered questionnaire to collect data on individual and work-related risk factors and the occurrence of musculoskeletal complaints and musculoskeletal sickness absence among 373
employees of laundry-works and dry-cleaning establishments. Both work-related physical and psychosocial factors showed strong associations with low-back pain and upper-extremity complaints. Work-related physical factors did not influence sickness absence, whereas psychosocial factors showed some associations with sickness absence.

Van Duijn et al (2004) measured interrelationships among pain, functional disability, general health and overall quality of life for workers on sickness absence for 2 to 6 weeks due to musculoskeletal complaints and assessed the impact of work-related and individual characteristics on these different health dimensions. A total of 218 workers on sickness absence for 2 to 6 weeks due to musculoskeletal complaints completed a questionnaire on four different health dimensions and work-related and environmental factors. Moderate correlations (r < 0.50) among measures of pain, disability, general health and quality of life were found. These health dimensions were not influenced by work-related physical and psychosocial workload, suggesting no impact of recall bias in studies for work-related musculoskeletal complaints. Self-perceived ability to return to work within 6 weeks explained 21% to 26% of the outcomes on pain and disability and contributed less to the generic measures of health.

IJzelenberg and Burdorf (2005) investigated whether demographic, work-related physical and psychosocial risk factors involved in the occurrence of musculoskeletal symptoms also determine subsequent health care use and sick leave. A questionnaire provided data on demographics and work-related factors, musculoskeletal symptoms and ensuing health care use and sick leave among 407 industrial workers. The 12-month prevalence of low back pain (LBP) and neck/upper extremity symptoms was 52% and 56%, respectively. Of those individuals with symptoms at baseline, 68% had a recurrence of LBP and 62% a recurrence of neck/upper extremity symptoms
during a 6-month follow-up. The recurrence of sick leave for a particular musculoskeletal complaint was approximately 30%, while recurrence of health care use was more than 40%. Recurrence of symptoms, health care use and sick leave were strongly associated with a history of severe symptoms. Physical load, high job strain and low social support at work determined the occurrence of LBP, related health care use and sick leave. Older age and living alone were also important risk factors, especially for sick leave. High job strain determined the occurrence of neck/upper extremity symptoms, related health care use and sick leave. Being female and living alone increased the probability of the occurrence of all 3 endpoints, especially the occurrence of sick leave.

Van Duijin et al (2005) determined which individual and work-related factors are associated with performing modified work and to evaluate the influence of modified work on the duration of sick leave and health-related outcomes among employees with musculoskeletal complaints. In this prospective study a total of 164 employees on sick leave for 2-6 weeks due to musculoskeletal complaints completed 2 questionnaires. Employees were less likely to perform modified work when their regular work was characterized by frequent lifting and their relationship with colleagues was less than good. Employees were more likely to return to modified work when they had a better mental health, had prolonged periods of standing in their regular job and had less skill discretion. Duration of sick leave was influenced by chronicity of complaints and disability, but not by modified work. Modified work, as the only advice given by an occupational health physician, did not influence the total duration of sick leave or the improvement in health during sick leave for employees on sick leave due to musculoskeletal complaints.
Lotters and Burdorf (2006) conducted prospective cohort study with 1-year follow-up to determine prognostic factors for duration of sickness absence due to musculoskeletal disorders. Workers were included when on sickness absence of 2 to 6 weeks due to musculoskeletal disorders. A self-administered questionnaire was used to collect personal and work-related factors, pain, functional disability and general health perceptions. The main factors that were associated with longer sickness absence were older age, gender, perceived physical workload and poorer general health for neck, shoulder and upper extremity disorders and functional disability, sciatica, worker's own perception of the ability of return to work and chronic complaints for low back pain. Workers with a high perceived physical work load returned to work increasingly slower over time than expected, whereas workers with a high functional disability returned to work increasingly faster over time.

Bot et al (2007) studied work-related physical and psychosocial risk factors for sick leave among patients who have visited their general practitioner for neck or upper extremity complaints. Three hundred and forty two patients with neck or upper extremity complaints completed self-report questionnaires at baseline and after 3 months. In the subgroup of patients who scored high on the pain coping scale "worrying" the hazard ratio of sick leave was 1.32 (95% CI 1.07-1.62) per 10% increase in heavy physical work. The subgroup of patients who were sitting for long periods of time had a reduced risk of sick leave as compared to patients who did not spend a lot of time sitting, again only in patients who scored high on the pain coping scale "worrying" (adjusted HR=0.17, 95%-CI 0.04-0.72). Other work-related risk factors were not significantly related to sick leave.
2.8 NEED FOR MUSCULOSKELETAL DISORDER PREVENTION AND INTERVENTION

Gerr and Letz (2000) examined the effect of two workstation and postural interventions on the incidence of musculoskeletal symptoms among computer users (376 persons using computer keyboards for more than 15 hours per week). The incidence of neck/shoulder symptoms and hand/arm symptoms during six months of follow up among individuals in the intervention groups was compared to the incidence in computer users who did not receive an intervention (comparison group). There were no significant differences in the incidence of musculoskeletal symptoms among the three intervention groups. Twenty two (18.5%) participants in the alternate intervention group, 25 (20.2%) in the conventional intervention group and 25 (21.7%) in the comparison group developed incident arm or hand symptoms. Thirty eight (33.3%) participants in the alternate intervention group, 36 (31.0%) in the conventional intervention group and 33 (30.3%) in the comparison group developed incident neck or shoulder symptoms. Compliance with all components of the intervention was attained for only 25-38% of individuals, due mainly to the inflexibility of workstation configurations.

In a study of Kaergaard and Andersen (2000) workers at two work sites (n = 73, n = 19) were advised to take three 30-second and one 3-minute break from computer work each hour, in addition to the regular rest breaks. Some workers were asked to perform stretching exercises during the short breaks. Mood and musculoskeletal discomfort were assessed at each work site over a 2- or 3-week baseline period and a 4- or 6-week treatment period, respectively. Worker productivity measures were obtained from the company records. No improvement in productivity or well-being was found at the
larger work site. At the smaller work site, productivity, eye, leg and foot comfort all improved when the short breaks included stretching exercises.

Hignett et al (2005) examined the participatory ergonomics interventions in a range of industries, including health care, military, manufacturing, production and processing, services, construction and transport. The definition of participatory approaches includes interventions at macro levels as well as micro, where workers are given the opportunity and power to use their knowledge to address ergonomic problems relating to their own working activities. Examples are given where a cost-effective benefit has been measured using musculoskeletal sickness absence and compensation costs. Other examples, using different outcome measures, also showed improvements, for example, an increase in productivity, improved communication between staff and management, reduction in risk factors, the development of new processes and new designs for work environments and activities. Three cases are described from Canada and Japan where the participatory project was led by occupational health teams, suggesting that occupational health practitioners can have an important role to play in participatory ergonomics projects.

Laing et al (2007) implemented participatory ergonomics programme in an automotive parts manufacturing factory in which an ergonomics change team was formed, composed of members from management, the organized labour union and the research team. It was hypothesized that the participatory nature of this change process resulted in enhanced worker perceptions for workplace, communication dynamics, decision latitude and influence, which in conjunction with anticipated mechanical exposure reductions would lead to reduced worker pain severity. Utilizing a sister plant in the corporation as a referent group, a quasi-experimental design was employed with a longitudinal, repeat questionnaire
approach to document pre-post intervention changes. Nine participatory activities (psychosocial interventions) were implemented as part of the process. Communication dynamics regarding ergonomics were significantly enhanced at the intervention plant compared to the referent plant. However, there were no significantly different changes in worker perceptions of decision latitude or influence between the two plants, nor did pain severity change. Possible explanations for these results include limited intervention intensity, context and co-intervention differences between the two plants, high plant turnover reducing the statistical power of the study and lack of sensitivity and specificity in the psychosocial measures used.

According to Seppala (2001), factors of the work, such as increased work pressure, high work organizational speed and lack of job security or decision-making opportunities, as well as low possibilities for development at work, may contribute to an increased occurrence of work pressure.

Aruin and Shiratori (2003) analyzed the effects of changes in body position and changes in the location of body supports on anticipatory postural adjustments (APAs). Eight healthy subjects were studied while sitting and standing. Subjects’ exerted upward or downward vertical force against an object attached to a rigid frame and released the object with a fast bilateral shoulder abduction movement. While sitting, four support conditions were studied: with and without feet support and with anterior or posterior lower-leg supports. The electromyography activity of leg and trunk muscles was recorded and quantified for APA activity. APAs in sitting with feet support were attenuated in the leg muscles but not in trunk muscles when compared with standing. In the sitting task, series with and without feet support showed no difference in APAs. Anterior or posterior supports to the lower legs while sitting were associated with enhanced anticipatory activity in biceps femora
and rectus femora muscles, respectively. However, trunk muscles showed similar anticipatory patterns across all the support conditions.

Bellemare et al (2006) conducted a study on musculoskeletal disorder prevention during facilities planning for a public service. Librarians were responsible for such projects and personnel working in the libraries before and after changes. Outcomes of the analysis served as a guide for ergonomic assessment of current situations and contributed to a better understanding of the way inclusion or improvement of prevention measures can support the workplace design process.

Rivilis et al (2006) assessed participatory ergonomic (PE) interventions to deal with work-related musculoskeletal disorders (work related musculoskeletal disorder). Using a longitudinal quasi-experimental design, evaluations were focused on 122 employees across the two depots who participated in both pre- and post-questionnaires. An evaluation framework assessed the process of implementation, changes in risk factors and changes in musculoskeletal health outcomes. Greater participation in the process was associated with increased levels of job influence and communication. Improvements in communication levels were associated with reduced pain intensity and improved work role function (WRF). Lower levels of pain post-intervention were related to greater WRF.

Cole et al (2006) assessed the impact of a workplace ergonomic program to reduce musculoskeletal burden among newspaper employees and to understand relationships among participation, risk factor changes and health status within an employee cohort. Among those with pain, 57% had consulted a health practitioner, including the on-site physiotherapist. In repeat cross-sectional analyses, the proportion reporting moderate pain or worse, at least once per month or for longer than 1 week, declined from 20 to 16%. Among the cohort, pain intensity and work disability in 1996 were the
strongest predictors of 2001 health status. Stable or increased supervisor awareness and concern about RSI was associated with decreased pain in 2001. Participation in RSI training was associated with increases in decision latitude, which themselves were associated with decreased work disability in 2001. Increased time müssing was associated with increases in work disability. Implementation of a worksite ergonomics program was associated with a reduction in frequent and severe pain in the workforce.

The literature reviewed reveals that there is no single reference found on occupational health problems especially musculoskeletal disorders among library professionals and library environment. Hence, the present study was proposed.

The methodology adopted for the study is presented in the research design.