

Consequence of Ergonomics in Construction Industry: A Review

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Abstract—Ergonomics is a science that involves tailoring a job to the needs of the workforce in order to make their jobs simpler, better, and more enjoyable. Workers in the building industry face stress due to health and mental problems, despite the fact that safety precautions are in place. The objective of the research is to determine how ergonomics are applied, as well as to determine the prevalence of musculoskeletal conditions and to recommend preventive steps in the development of special techniques and movement for each task with a higher potential cause. We have intended to talk about the obstacles to ergonomics execution. This research should be seen as a starting point for potential development planning and ergonomics research.

Keyword-Ergonomics, Musculoskeletal disorder, Construction works, labour safety

I. INTRODUCTION

Ergonomics is the study of how to schedule a job such that it is optimal for the individual, reducing accidents and increasing productivity. Carrying heavy objects, repeated walking, uncomfortable postures, and touch force vibration all contribute to ergonomic threat and severe injuries such as work-related musculoskeletal disorders (MSDs), sprains and strains. Construction staff experience suffering and pain in their shoulders, backs, necks, thighs, and other body parts as a result of their daily work. In light of the employees' financial situation, they opt for local solutions to alleviate their physical inconveniences. Conversely, due to this MSD problem, some building laborers become inadequate for work. The Occupational Safety and Health Administration (OSHA) requires employees to have a clean and secure working atmosphere. Ergonomics aids in the discovery of a path for workers to live in a risk-free region. The worker is mostly accountable for providing a secure working atmosphere, and workers should establish routines that cause them to feel good and relaxed. Ergonomics might indeed be built in such a way that it protects workplace personnel from muscle aches and injuries. If Ergonomics is not well maintained, workers are at risk of developing musculoskeletal conditions, which can be fatal. According to new research, building crews suffer from double the number of work-related accidents and illnesses than the typical worker in the rest of the sector. The World Health Organization (WHO) defines "job-related" disorders as multi - factorial, implying that a variety of risk factors, including work operational, psychologic, physical, human, and socioeconomic problems, play a vital role in the development of such disorders.[3]. The aggregate of these problems identifies working ability and reduces person employee job satisfaction. Building employees seem to be continually subject to undesirable ergonomic difficulties due to the vast variety of tasks included in the design phase when it evolves. The construction sector has the huge worker accident and accidental death rates, making it a high-risk area for Work-Related Musculoskeletal Disorders (WMSDs) in particular[4,5]. Musculoskeletal Disorders (MSDs) continue to be the most common type of professional sickness, necessitating an investigation into why management of the phenomenon is being less fruitful than anticipated [6]. The most popular job-related health issues are musculoskeletal disorders. For example, 25% of staff in the European Union (EU) report backaches, and 23% report muscular pains. Musculoskeletal disorders were the leading source of work loss in the United States [6]. Musculoskeletal accidents, such as strains and ankle sprains, are the most frequent non - fatal workplace injuries in the United States, resulting in absence from the work.

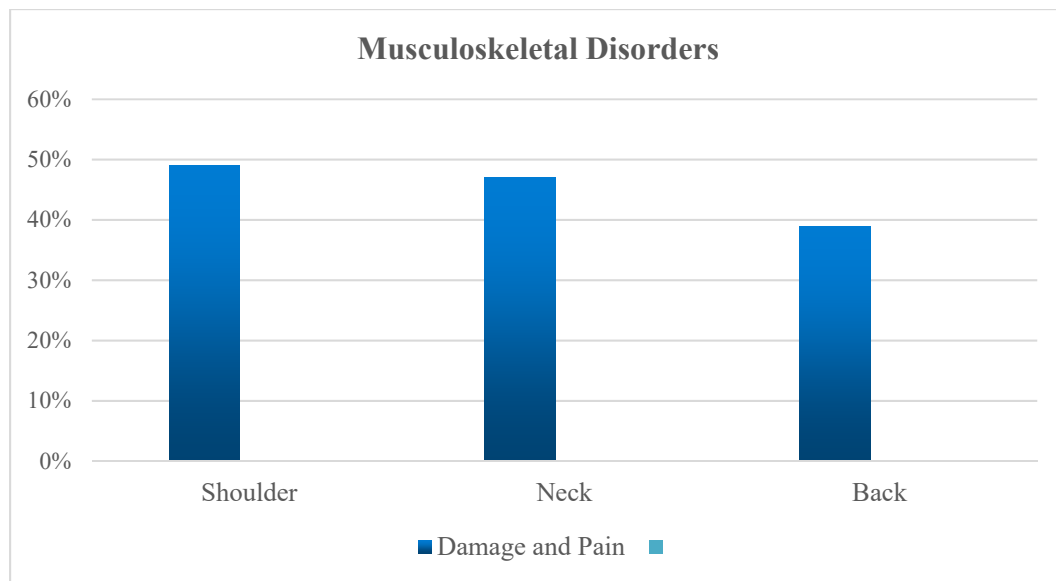


Fig. 1. Survey on MSD

The shoulder was the most detected body part shoulder (49 percent), followed by the spine (47 percent) and back (39 percent), in that order [7].

In the Scottish building industry, over than one of every five workers has registered work related musculoskeletal disorders, which account for about 69 percent of all work-related accidents recorded in 2005 [8]. Smallwood stated that the use of body force, stretching away from the body, rising above the head, repeated motions, stretching or turning the spine, ascending and declining is normal and signify work-related job problems based on the results of an ergonomics report by South African construction management and staff. [9]. In developed nations, the scenario is much worse. Many developed nations, such as Tanzania, Nigeria and Thailand had even higher rate of injuries and accidents than countries in Europe. Since serving on a construction area, a construction worker was certain to be momentarily unable to function at some point due to potentially severe accidents or chronic illnesses. [10]. And almost every accidents and disorders in the building sector, on the other hand, appear to be treatable, yet health and safety factors are directly linked to the coordination of construction industry and the execution of administrative processes. [11]. Inadequate coordination of site data and measurement machineries are likely to cause the majority of threats in the building sector [12].

This implies that if construction firms are experienced with all of them and understand how to recognize all of the possible risks, they will avoid those hazards and accidents. Construction employees, on the other hand, should be mindful of their vulnerability to damage or occupational injuries in the working environment. As a result, if accurate and complete knowledge about working environment, ongoing training and manual activities, and education are established, the building sector's quality and safety output may be dramatically enhanced.

II. ERGONOMICS IMPORTANCE IN TODAY'S MODERN WORLD

Building employees were subjected to physical and psychological problems at different phases of their employment in the sector. Ergonomics is a field of research that aids in raising awareness among employers about the physical and psychological problems they encounter at workplace. Ergonomics further boosts workplace productivity by delivering training and guidance through warm-up activities, allowing workers to function without any discomfort and in a healthy atmosphere.

Employers are pleased as a result of following:

- ✓ Productivity will have an increase.
- ✓ Reduces the worker's emotional tension.
- ✓ As a result of the reduction in accidents and injuries, the payout cost is reduced, and the employee benefits as well.
- ✓ Stress in the musculoskeletal system should be reduced.
- ✓ The number of major injuries and accidents have been decreased.
- ✓ Absenteeism can be minimized.

- ✓ Increased self-assurance of the overall company and its employees will be able to identify the early signs of musculoskeletal discomfort and will be able to minimize the common health risks, allowing the organisation to complete projects more quickly.



Fig. 2. Survey on MSD

III TYPES OF ERGONOMIC DISORDERS

A. Carpal Tunnel Syndrome (CTS)

It is a medical issue caused by compression of the radial artery when it passes through the carpal tunnel in the wrist. Pressure, loss of feeling, and itching in the thumb, middle finger, index finger, and ring finger's thumb side are the most common typical problems. Usually, symptoms may appear slowly and in the middle of the night and the pain can radiate up an arm. There may be a loss of grip power, as well as the tissues at the base of the thumb will drain away over time.

Exercises: Stretch the arm beside you with the palm facing up. Fold your wrist and then point the hand to the ground. Slowly flex your wrist using your other hand till you sense a mild-to-moderate pressure in your forearm. For minimum 15 - 30 seconds, hold in the same position. Repeating it 2-4 times more can reduce the stress.

B. Tendinitis

Inflammatory response or pain of a muscle, the dense fibrous tissues that connect muscles to the bones, causes this condition. Pressure and tenderness are felt outside a joint in this state. Tendinitis could even affect all the tendons, but it is most prevalent in the areas of your elbows, shoulders, wrists, knees, as well as feet.

Exercises: Healthcare professionals and physiotherapists frequently offer the RICE programme as an emergency treatment for over prescription of tendinopathy: rest, ice, compression, and elevation of the wounded tendon. They might even prescribe ibuprofen, aspirin, or any other anti-inflammatory painkillers for a short period of time to help with inflammation and pain relief.

C. Trigger Finger

This condition occurs when one of the fingers becomes trapped in a bent stance. With just a snap, the finger can be bent or straightened, similar to a trigger mechanism.

Exercises: Extensor's of the fingers are stretched. Place your hand horizontally on a desk or other firm surface. Hold the injured finger with the other hand. Raise the finger gradually while keeping the other fingers flat. Raise the finger as far as it can go without tensing it. Hold the position for a moment before releasing it.

D. Disc Injuries

High pressure or damage in the spine may lead to an injury in the cushioning and connective tissue between the vertebrae. Back discomfort, pain or feeling in various body parts, and disability by physically are all potential outcomes. MRI seems to be the most accurate screening method for disc herniation and medications include anything from pain pills to treatment. Fundamental energy and knowledge of body parts, like stance, are the best ways to avoid disc herniation.

E. Tension Neck Syndrome

It is a neck stiffness and discomfort, as well as trapezius muscle tenderness. Tension neck infection is caused by weakness, discomfort in the neck, neck pain, and headache caused by pain in the neck. Minimum two tender areas or tiny, hard nodules, also known as trigger points, are present.

Exercises and stretches: Keep your left hand on top of the head and the right hand down your bottom. Pull the head slightly to your right until your ear is nearly hitting your shoulder. Repeat on the other side after 30 seconds.

F. Raynaud's Syndrome

Raynaud's syndrome is a rare blood clot condition that affects the toes and fingers. When you feel chill or nervous, it leads to constrict your blood vessels. Blood cannot flow through the skin layer when this happens, and the damaged region transfers blue and white.

Exercises: Regular physical activity is also intended for patients with primary Raynaud's disease since it will help with metabolism, stress relief, and general fellow human. However, one should eliminate practises that lead to increased risk for numb toes and fingers, as well as foot and hand injuries.

IV. OBSTACLES IN IMPLEMENTATION OF ERGONOMICS

Regardless of the fact that ergonomics has emerged as a beneficial idea to plan a job, there are several challenges that will be important to the situation.

A. Inertia

Ignoring ergonomics is justified for a variety of reasons, including old adages like "this is how we've always done it," blaming issues on staff, and arguments that ergonomics isn't really an "exact science"(Hwaiyu Geng, 2004). Contractors who feel comfortable with present work practices, oppose improvement, and regard propositions as criticisms contribute an essential part in cultural action.

B. Financial

Including an expense to the final cost is unappealing to contractors, who prefer to use less costly building techniques to achieve an additional advantage in the tendering process (Glimskar & Lundberg, 2013). Contract workers lack a long-term perspective; some save funds where they should not yet invest it on restructured settlements and work injury expenses.

C. Time

Ergonomics entails the implementation of basic and creative techniques that improve the quantity being manufactured; moreover, a few of the tools would necessitate further activities for employees to become compatible with the latest methods. Such concept of transition is unappealing to employees and suppliers who are slow to react (Wiberg, 2012).

V. FACTORS CONSIDERED TO IMPLEMENTATION OF ERGONOMICS

List of Factors considered to implementing the ergonomics at work site:

- ✓ Physical Risks
- ✓ Particles in the Dust (lifting sand, Lifting bricks, Lifting gravels, Dust Sampling, Asbestos powder control and measurement)
- ✓ Noisy environment (Due to Mixer machine, Bar cutting machine, Drilling)

- ✓ Ventilation
- ✓ Inefficiency of equipment
- ✓ Vibration (Using vibrator, Due to Drilling, Cutting reinforcements)
- ✓ Luminescence (Lighting and protection, lighting and function, artificial lighting sources and values, fundamentals of better lighting, lighting installation design)
- ✓ Chemical Hazards (Solids, Liquids, Gases - Irritant gases, toxic gases, asphyxiating gases, Accidents in Confined spaces, Sewages, CETPs. Acids, Solvents, Alkalies, Pesticides, Reactive chemicals- Chemical Process Safety, Storage, Transport, Chemical handling- Heavy metals, Particulate-Silica, Asbestos.
- ✓ Biological hazards-Bacterial, Viral, Fungi, Moulds- Exposure evaluation, Sampling methods, Biological surveillance, Personal surveillance, Threshold Limit Values (TLV), STEL. Biological hazards (Bacterial, Viral, Fungi, Moulds,), Hospital Waste management.

A. Excavation and Foundation Work

Earthworks and site planning entails moving soil in order to obtain a good standard. This method involves digging ditches for foundations and footing, raising level in lower elevations, and backfilling areas where initial progress has been made with heavy machinery. The exploration of the location has begun, which will necessitate the use of massive earth-moving machinery. The ergonomic risks of such an equipment, as a whole-body movement and a bad seat design, are quite well.

And particular, operators must frequently twist and turn when driving in reverse. A research of massive machinery technicians by the National Institute of Occupational Safety and Health (NIOSH) discovered many musculoskeletal disorders related to vibration exposure.

The forms being separated just after concrete has been pumped into them and left to settle. Since work is mostly performed in trenches, this job necessitates some challenging stance.

B. Masonry

This method necessitated a huge number of raising and transporting of brick masonry by hand. Despite the fact that there was not a lot of brick masonry involved, laying of bricks has been exposed to pose major ergonomic risks to staff. Bricklayers carry around 1000 bricks each day on average, totaling 2300-4000 kg (5000-8800 lbs) of carrying and 1000 trunk-twist flexions. As a result, approximately 87 percent of bricklayers experience lower back issues over the course of their career.

Bricklaying is also a reason for the muscular exhaustion. The lateral loads are demonstrated to be extremely heavy, when one lays the bricks on a low wall, this is particularly true (10cm, or 4inches high). Due to the height change of the job, continual stooping to get resources and position them on the wall with accuracy puts a lot of pressure on the back. Extendable scaffolds, according to the researchers, should be used to maintain the functioning altitude about 60 to 90 cm (2-3 ft). Furthermore, brick supply stacks will be a minimum of 50 cm thick (20 inches). One of the benefits of such a scheme has been a 100 percent rise in efficiency.

C. Concrete Reinforcement

Concrete-reinforcement employees experience severe risks of ergonomic accidents, according to research. A review of finish workers in 1974, concrete-reinforcement workers were found to be more affected by challenging work stances than any other group. Studies by Wickstrom, etc., published in 1978 showed 84% of concrete reinforcement workers reporting back trouble, 42% sciatica, and 33% lumbago. A typical workday caused nearly 50 % of participants to experience aches, exhaustion, including stiffness, and 20% experiencing tingling sensation. Sciatica was linked to length of jobs; however, degeneration of disc was not really because of affected workers retiring earlier. In 1989, a general study discovered that labourers with lumbar disc degeneration had a greater chance of back pain. To avoid issues among concrete labourers, the researchers note that further corrective steps are necessary.

To improve the reinforcement working atmosphere, certain work activities and instruments have been invented. One most daunting challenge for staff is pulling reinforcement from the surface storage. Reinforcement bar storage devices put reinforcement closer to the working environment, reducing transportation, and storing them at hip level, allowing workers to lift those reinforcement bars without any risks. In Sweden, staff use a "tying automat" (a metal extension system with a stimulating handle at hip level) to hook reinforcement bars from a head level. It has even been proposed that rather than steel reinforcement, welding fabric nets can be used to bring

down the need for tying. The Swedish cement and concrete research institute has investigated this and possible floor reinforcement methods.

D. Formwork

The word "formwork" refers to a wide range of moulding processes used in concrete construction. The majority of commercial carpenters now work in concrete structures. Field-constructed plywood or metal systems are the most common systems for masonry structure. Construction of pan, slip shapes, tilt-up prefabricated structures, and post-tensioned systems are examples of alternative concrete construction systems. Depending upon the method being implemented, the ergonomic risks of concrete methods may vary.

Footings, beams, columns and walls are examples of generally constructed concrete structures. Every structure has some formwork, ranging from a simple shaped floating slab to a structure with a completely concrete structural element. The ongoing infrastructure project examined for this review had very small-scale formwork, and majority of the structure consisting of slabs, footings, and partition walls.

Vertical plywood panels cut to size utilizing electric power saws are the much popular shaping method. The most familiar saw is now a "worm-drive saw," which gets its name from the fact that the motor is at an angle of 90° to the blade. This form of saw is normally far gentler than a typical circular saw with a direct drive. It is heavy (8.6 kilogram/16 lbs) and badly designed from an ergonomic standpoint. The saw's weight is focused in the area beneath the handle. For certain jobs, the repeated raising of this sort of saw from the surface to the worktable can be an ergonomic threat.

E. Structural Steel Work

On-site, an ergonomic evaluation of structural steel work was done. Uncomfortable stances, maximum force demands on occasion, stable stances, repeated motions, hydraulic machine use, and raising have all been proposed as possible ergonomic issues for structural steel employees. The load - bearing members in particular. Kneeling and bending are often needed when welding the decking in location.

Crane engineers play an important role in this process because steel reinforcement is lifted into position by cranes. Crane engineers face ergonomic challenges when it comes to the precise moving and positioning of extremely heavy weight. As products are frequently positioned at a distant location from the crane (and sometimes out of contact), a person should warn the engineer with hand. Eyesight and the potential to notice the hand gestures are put to the test. Crane engineers are often exposed to entire-body vibration and noise.

VI. CONCLUSION

The building sector's ergonomics concept and adverse outcomes were the subject of this report. Ergonomics can be described as the connection between people, career development, machine systems, and the workplace surroundings, according to the study. In general, ergonomics aims to adapt the role to the person rather than the other way around. The research also discovered the much more important ergonomics potential risks or factors that could raise the risk of musculoskeletal injury. Working in an uncomfortable pose, movement, and pressure from grabbing, raising, pulling or pushing are all hazardous. Doing work in severe temperature conditions, either severe cold or hot, or repetition, which means performing a job that involves alike muscles again and again with no chance of redemption, are both leading causes. Serving in an awkward posture or causing muscle and tendon contact tension increases the risk of complications.

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