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A STUDY OF PLAUSIBLE ERGONOMIC RISK FACTORS IN CONSTRUCTION INDUSTRIES AND ITS EFFECTIVE REMEDIAL MEASURES

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Abstract - *Now a days the construction industry is growing especially among developing countries. It is one of the highly risky industries with more number of accident and injuries. Work related musculoskeletal disorder are the most common injury caused by job activities and conditions like lifting, repetitive motion and work in confined area. They may become long haul and incapacitating medical issues that shield individuals from working and getting a charge out of life. Ergonomics can help to shield your body from wounds .Using ergonomics amid the work exercises, makes the work simpler on your body and regularly encourages you to discover approaches to do your work all the more proficiently. The reason for this examination is to recognize the ergonomics chance factors in building site and to discover arrangements utilizing ergonomic work technique, tools or equipment and correct postures. This can be done by site visit and through questionnaire to employees. This was done by site visit and asking questionnaire from the employees of the construction industry.*

***Key Words*: construction industries, ergonomics, risk factors, musculoskeletal disorder, injury**

1. INTRODUCTION

Ergonomics can generally be characterized as the investigation of individuals' effectiveness in their workplace. The word ergonomics is started from the Greek word consequently implies work and nomics implies laws relating or measures. There for Ergonomics is "the laws relating to work, the proportion of work" According OSHA, 1994 ergonomic is the study of "planning the activity to fit the laborer, instead of driving the specialist to fit the activity."

Great ergonomics begins with the workplace, from the seating to the lighting, and likely finishes with the work hours and the genuine remaining burden that a worker is required to have done. Ergonomics is the manner in which you utilize your body to work and fitting the activity or assignment to you to decrease your danger of damage. Hazard factors are available at different dimensions for various occupations and assignments. For the most part, the more worthy the presentation to a solitary hazard factor or mix of hazard factors, the more noteworthy the likelihood of ergonomic damage or sickness, additionally called Work Related Musculoskeletal Disorder (WMSD). This proposition looked into about recognizing the hazard factors present in the ventures and to build up some viable medicinal measures, ergonomic instruments and strategies to lessen and wipe out the hazard factors.

This investigation encourages the labourers to be progressively mindful about the significance of ergonomic in work spot and refresh the information about hazard factors and the therapeutic measures to lessen the equivalent

1.1 Ergonomic Risk Factor

Ergonomic hazard factors are attributes of work that add to the making of ergonomic weight on the body. Hazard factors are available at different dimensions for various occupations and errands. By and large, the more prominent the presentation to a solitary hazard factor or blend of hazard factors, the more noteworthy the likelihood of ergonomic damage or ailment, additionally called Work Related Musculoskeletal Disorder (WMSD). Principle classifications of hazard factors are biomechanical exposures, psychosocial stressors, singular hazard factors, Health factors, Work related variables. Biomechanical exposures incorporate factors, for example, inadequately structured work environments and biomechanical exposures, for example, redundant movement, high powers and deviations from nonpartisan body arrangements. Psychosocial stressors at work incorporate factors, for example, high-saw work environments stress, low-saw social help, low seen occupation control, and time weight.

Department of Employment and Industrial Relations mention that, the main five ergonomics risk factors are

1.Forceful exertions which is include the quantity lab or lifting ,how pushing ,pulling or using excessive force to perform tasks ,these tasks which required forceful exertion place higher loads on the muscles, joints, ligaments and tendons.

2. Repetition which is rehashing a similar development through the workday (how frequently the business play out the undertaking), Repetitive activities as a hazard

factor can likewise rely upon the body zone and explicit act being performed.

3.Awkward postures the body position figured out which muscles and joints are utilized in a movement and measure of power used(spinal plates open to more pressure while lifting substantial article, different undertakings requiring rehashed or supported twisting of the wrists, knees, hips, or shoulders additionally increment weight on these joints).

4. Vibration happens when a particular piece of the body contact with vibration instrument like working hard core vehicles or expansive apparatus.

5.Duration the measure of time individual is constantly open to hazard factor, and utilizing a similar muscle or movement increment the likelihood of WRMD

1.2 Categories of Risk Factors

- **Bio-mechanical exposures-**
  - Awkward posture
  - Repetition
  - Static posture
  - Vibration
  - Force
  - Contact stress
  - Extreme temperature
  - Sustained exertion
  - Fatigue
- **Psycho-social stress**

a) Administrative risk factors
  - Administrative stress
  - Job rotation methods
  - Staffing levels
  - Excessive over time
  - No of rest breaks
  - Stress from dead line
  - Training levels
  - Work pace

b) Environmental risk factors
  - Noise
  - Lightings
  - Glare
  - Air quality
  - Temperature
  - Humidity
- **Individual factors**
  - Gender
  - Age
  - Negative stress
  - Reaction
  - leisure time
  - Domestic work load
  - Knowledge
  - Culture
  - Goals
  - Expectations
  - Attention
- **Health factors**
  - Diseases
  - Body pain
  - Illness
  - Injuries
  - Physical strength
- **Work related factors**
  - Communication
  - Tools & equipment
  - Work place size and shape
  - Personal protective equipment
  - Work procedures
  - Work platform
  - Work position
  - Management support

1.3 Work Related Musculoskelital Disorder

Ergonomic dangers can make agonizing and handicapping wounds joints and muscles on the building site. More prominent the presentation to a solitary hazard factor or mix of hazard factors, the more noteworthy the likelihood of ergonomic damage or sickness, additionally called Work-Related Musculoskeletal Disorders (WMSD).

As per the World Health Organization, musculoskeletal scatters are business related when the workplace and execution of work are noteworthy supporters of their improvement or compounding (WHO, 1985). Business related musculoskeletal confusion are the most widely recognized damage brought about by occupation exercises and conditions like lifting, dreary movement and work in limited region. Business related MSDs happen when the physical capacities of the laborer don't coordinate the physical prerequisites of the activity. Delayed presentation to ergonomic hazard variables can cause harm a laborer's body and lead to MSDs. MSD's are wounds to muscles ligaments and nerves that are brought about by an excess of physical pressure causing tissue separate ie, tendonitis, carpal passage and rotator sleeve disorder. They can turn out to be long haul and crippling medical issues that shield individuals from working and getting a charge out of life. Musculoskeletal confusion or ailment is one including the muscles, ligaments, tendons, nerves, joints, bones, or supporting body tissue. Wounds incorporate disarranges of the back, the neck, the upper or lower body limits, or the shoulders and are related with strains, sprains, or tissue aggravation, and disengagement

2. RESEARCH METHODOLOGY

Find out the ergonomics risk matters in the construction sites. It was followed by the collection of data through interview and questionnaire survey with construction workers. The analysis was done by the method named Important Index Technique (IMPI).

2.1 Data Collection

The information gathered to decide the most persuasive ergonomic hazard factors in the building site was done through a study by explorative poll to the respondents engaged with every day exercises of development firm. The survey was structured with the goal that respondents can give the position to their answers dependent on their assessments. Information has collected from 30 respondents of the building site by utilizing meeting plan. The poll header part contains fundamental data about the respondent and the survey and some space at the remainder of the survey is given to think of certain remarks in the event that they have any uncertainty about the investigation or the survey

2.2 Analysis

The investigation of the information was finished by a strategy named vital list (IMPI).Importance Index system: In this procedure, for each reason/factor two inquiries ought to be solicited: What is the recurrence of event for this reason? Furthermore, what is the level of seriousness of this reason on undertaking delay? Both recurrence of event and seriousness were ordered on a four-point scale. Recurrence of event is arranged as pursues: dependably, frequently, now and again and once in a while (on 4 to 1 point scale). Thus, level of seriousness was arranged as pursues: extraordinary, incredible, moderate and little (on 4 to l point scale). Recurrence file: A recipe is utilized to rank reasons for defer dependent on recurrence of event as distinguished by the members.

Frequency Index (F.I.) (%) = Σ a (n/N) * 100/4

Where, **a** is the constant expressing weighting given to each response (ranges from 1 for rarely up to 4 for always), n is the frequency of the responses, and N is total number of responses.

Severity index: A formula is used to rank causes of delay based on severity as indicated by the participants.

Severity Index (S.I.)(%)= Σ a (n/N) * 100/4

Where **a** is the constant expressing weighting given to each response (ranges from I for little up to 4 for severe), n is the frequency of the responses, and N is total number of responses.

Importance index: The importance index of each cause is calculated as a function of both frequency and severity indices, as follows:

Importance Index (IMP.I.)(%) = [F.I.(%)* S.I. (%)]/100

3. FINDINGS

- Bio mechanical factors causes risk such as contact stress on tendons & muscles, awkward posture, repetition, force are the most significant factors.
- Psycho social factor compress of administrative factor and environmental factor. In administrative risk factor, stress to complete works on dead line and low training level are the main problem that workers facing in the workplace. Extreme temperature is one of the main environmental risk factor that affects the safe working atmosphere.
- In Individual factors, the negative stress and risk in reaction are the factors affect worker mostly. Majority of the workers were aware about the importance of using the safety equipment.
- Health factors like body pain, physical strength, small injuries and illness are affecting the labour's productivity and performance of workers.

Work related factors like uncomfortable workplace, uncomfortable working posture, and adverse work platforms are significant factors affecting the working efficiency of the workers.

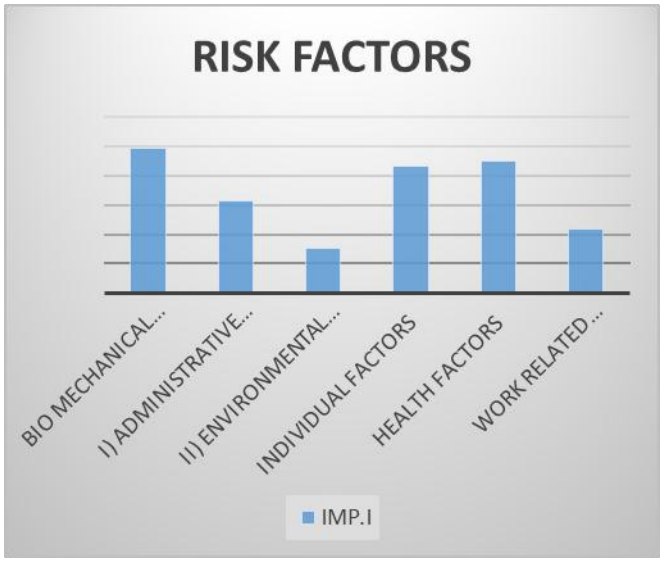

Chart 1.IMP.I of risk factors

4. SUGGESTION

4.1 Control Methods for Ergonomics Issues

1. **Eliminate the hazard** – This is the preferred method and most effective solution. It is controlling the hazard at the source.
2. **Substitute** – If elimination is not possible, consider substituting or replacing the known hazard with a material, process, or equipment that less dangerous.
3. **Engineering control** – A strategy involving denying access to the hazard by installing physical barriers. This could be a redesign of equipment or work processes to reduce the intensity of performing dangerous works. Or the isolation of the hazard by installing barriers or screens around hazardous areas.

4. **Administrative control**– At the point when introduction to the hazard isn't, or can't, be limited by different methods, you ought to acquaint safe work practices with decrease the hazard.
5. **Personal Protective Equipment** – Introduce PPE to increase protection and when other measures are not practical.

4.2 Types of Ergonomic Tools

1. **Communication**- Verbally communicates the importance of ergonomics as means to a healthy, efficient and safe workplace. Express enthusiasm to give a message that the program is critical and to ingrain vitality and nature of work in representatives. Express the program goals clearly.
2. **Management control** - Management must comprehend the part security can play in organization system. The primary administration controls should be possible through building control, which required a structuring or updating workstation, instruments and strategy so as to take out the word related hazard factors. The second administration controls is authoritative controls, by giving rest breaks to recuperate from work initiated exhaustion, Increasing the quantity of representatives doled out to an undertaking to circulate the general burden over a bigger number of people, work pivot, work extension and by building up a powerful instrument to guarantee that offices, hardware and apparatuses are very much kept.
3. **Ergonomics design factors**- The ergonomic way to deal with work place configuration must be perceived at the before stage and be considered as a standout amongst the most important factors in planning a working environment as reasonable plan will be the best and it is the main decision for controlling wellsprings of working environment stress. Emphasize that the focal point of the avoidance mediation was adjusting the current workstations, rather than giving new furnishings or gear.
4. **Training and Education**- Training and instruction are a powerful method for expanding familiarity with ergonomics issues (for example CTDs and back wounds) and settling issues before wounds happen. Ergonomics training permits directors, chiefs and representatives to comprehend business related perils with work.
5. **Written Ergonomics programs**- Develop a composed ergonomics program articulation which plots the objectives and plans for the program and its help .The program proclamation ought to protect that representative prosperity and profitability have been tended to.

4.3 Ergonomic Tools Used In Construction Site

There are numerous ergonomic instrument that can be acquainted in the building site with decrease the ergonomic hazard factors and to increase the efficiency of workers.

1. Brick tongs :-
A grasping instrument with two arms that joined, at one end as by a scissor or pivot like hinge. It used for lift the brick for long distance. It made up of steel with lower weight. It can carry up to 10 bricks. It helps to reduce the contact stress on back and neck during lifting of bricks.

2. Bricky tools
It used for spared the mortar without touching, that reduce the numbness and burning sensation for workers. It made up of thermo set plastic materials with adjustable sizes

3. Pulley with buckets
It used for vertical transfer of mortar or other material by using rope and bucket

4. Adjustable working platform
One way that adjustable scaffolding increases safety at the job site is by reducing injury and stress by providing a larger workspace than traditional scaffolds

5. Regular exercise
The Work Strong Program (WSP) focuses around teaching make labourers in close to home implication of solid skeletal wounds, legitimate lifting strategies, and extending/warm up procedures. A definitive objective of the Work Strong Program was to limit and in the long run take out lift related wounds both in the work environment and at home. Ensuring your colleagues are physically prepared for work lessens damage hazard and advances a wellbeing, security and group culture. Extending is a main piece of a sound wellness routine. Pre-move extending and warm-up activities decrease the danger of musculoskeletal wounds by diminishing weariness, improving solid parity and act, and improving muscle coordination.

6. Increase management commitments
The executives should build the connection among works and the board. The board makes report about of hazard in individual works.

7. Workplace Athlete Training
Preparing working environment competitors is a fundamental component of the MSD avoidance process. They should be prepared on the advantages of the above managerial controls and learn musculoskeletal self-care best practices. Classroom preparing ought to be caught up with one-on-one application preparing by accomplished damage counteractive action expert.

8. Proper Lifting / Handling Techniques
Instructing workers on legitimate lifting strategies ought to be a key representative preparing objective in your training program. Specialists are settling on choices minute by

minute that influence their work and the toll it takes on their bodies. Instructed choices and practices require training

9. Team Lifting
At the point when a heap surpasses prescribed weight limits, work environment competitors ought to be required to play out a group lift

10. Musculoskeletal Self-Care, Rest and Recovery
As referenced before, musculoskeletal wellbeing ought to be a normal theme in classroom instructional courses and afterward followed up routinely by damage avoidance authority with one-on-one interviews. This is a continuous procedure to make wellbeing and security culture and advance by and large wellbeing and health of working environment competitors.

11. Early Intervention – Identify Early Signs of Fatigue
Identify Early Signs of Fatigue, Early intercession is a proactive system to discover early indications of damage and keep it from occurring. At the point when representatives remember they are encountering weakness and inconvenience (early cautioning indications of MSD), they are urged to report it. When the issue is accounted for, self-improvement apparatuses ought to be promptly accessible to the worker through accomplished damage counteractive action expert. Early mediation is about avoidance, not treatment. It tends to weariness and distress before it turns into an excruciating musculoskeletal turmoil (MSD) and an expensive case for the organization.

5. CONCLUSIONS

Ergonomics is structuring an occupation to fit the labourer so the work is more secure and progressively effective. Executing ergonomic arrangements can make workers progressively agreeable and increment profitability. Ergonomic dangers and inert condition somewhat exist in practically all work framework and can be missed in standard hazard appraisal endeavours. Numerous association dubious of the ergonomic hazard level in their activity or the effect it has on the business, have a huge open door for development. For an association to improve its capacity to oversee ergonomic peril, a successful ergonomic hazard evaluation process is expected to diminish hazard to an adequate dimension. The point of the examination was to concentrate on distinguishing the hazard factors present in the ventures and to set up some successful medicinal measures, ergonomic instruments and techniques to decrease, take out the hazard factors, make attention to ergonomics inside building site and shield labourers from WMSDs. Working in awkward position like unbalanced stance, reiteration, contact weight on muscles and ligaments will builds the opportunity of WMSDs and lessens specialists execution. Poor ergonomics rehearses in building site may prompts high potential hazard for specialist's wellbeing and security.

It is must to apply the ergonomics gauges to keep a solid live. While ergonomics is a relative new field of study, it is obtaining significance around the world. We have to consider how we functioning, about our stances and propensities. It is dependably a decent time to learn and improve. Ergonomics encourages individuals to be progressively agreeable at work, lessening pressure and damage brought about by off base situating and redundant undertakings. As a decent client, we have to utilize ergonomics since it gives huge impact in our life.

In this investigation direct meeting and survey with development labourers and that outcome was discovered the development specialists had high agony and uneasiness in their body parts amid and after their work execution. From the investigation we can reason that Working in awkward position like ungainly stance, redundancy, contact weight on muscles and ligaments builds the opportunity of WMSDs and decreases labourer's execution. WMSDs are expansive weight of malady among development specialists and cause noteworthy weaknesses in physical and emotional wellness in their day by day exercises. Execution of ergonomics instruments in building site will improves the specialist's productivity. The improvement in work spot or work techniques diminishes WMSDs and expands specialists' profitability. Labourers pursued standard ergonomic preparing and warm-up exercises in building site, which will lessen specialist's non-attendance and weakness torment in their body parts and furthermore improve specialist's wellbeing and security. Development specialists keep on confronting a higher danger of WMSDs. Ergonomic arrangements that decrease overexertion-the essential presentation for WMSDs-ought to be embraced broadly at building destinations, especially for labourers with a higher danger of WMSDs

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