*National Conference*

*on*

# Occupational Health and Stress
## (OHAS–2011)

25-26 February, 2011

## *Proceedings*

*Editor*

Dr. R.I. Sathya

*Organised by*

Gandhigram Rural Institute-Deemed University

*(Re accredited by NAAC with 'A' Grade)*

EXCEL INDIA PUBLISHERS

New Delhi

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# Kingpin Milieu of Safety and Occupational Health Hazards–The Unorganized Sector and Women Labourers

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*Abstract*—**Unorganised sector with its telltale features of fatiguing job patterns, non-ergonomic work environments, work overload, mental and physical stresses, humiliation, insult, harassment, unsafe work environments, job insecurity and social isolation, render women labourers in these sectors – the maximum represented group – vulnerable, physically strained and mentally/emotionally trapped. They are helpless with lesser possibility for social security and health insurance. They live the lives of the victims of destiny and suffer many occupation impacted distresses including work related musculo-skeletal disorders (WMSDs), orthopaedic, gynaecological, pulmonary and skin related diseases. Women, again, are the victims of multi-tasking as they bear the responsibilities of the household and the work spot alike. In both the situations, they emerge the invisible, but the conspicuous contributors. For these women, domestic work, perhaps, is yet another unorganized sector to which they switch over alternately from the work spot. The cumulative effects of these environments definitely leave a negative signature in the form of health hazards and an eternal strife for visibility and identity. This paper discusses the plight of women labourers in three such unorganized sectors. The findings focussed that all the labourers (irrespective of the sector working in) were prone to WMSDs, Chemical pollutants and ergonomic problems.**

***Keywords: Job insecurity, work overload, WMSDs, unorganized sector, identity***

## I. Introduction

Traditional India had seen the woman only as a member of the family or group and not as an individual with an identity or rights of her own. People spend most of their lives working for a living. Rising labour productivity and higher wages affect decisions about who in the household should work. Indirectly they also decide the type of work, the income they receive, the management practices and sector of work, affirms the World Development Report. In the fast changing scenario, the world over, women are emerging as a concrete work force, entering all fields of economic activity despite the discriminations they face. Though they contribute substantially to the household's economic resources both by way of services rendered and wages earned, their potential is not duly recognized and very little attention is paid to involve them directly with developmental activities. Nonetheless, the social and economic conditions of women in India require rational approaches to change.

Health is one of the important indicators for the assessment of the status of women in any society. Health today encompasses a great number of critical contemporary issues. These range from the influence of diet and exercise on longevity to environmental pollution. It is a relative state of ability to mobilize one's resources, to respond effectively with one's environment and to the stresses that come one's way. It is the most valuable possession throughout life and maximum effort should be put in to maintain and promote it.

By occupational environment is meant the sum of the work and the external conditions and influences which prevail at the place of work and have a bearing on the health of the working population. Ergonomics gives an overview of the customs, habits and laws of work, the benefits of which are measured in terms of human comfort, efficiency and well being. Job related ergonomic stresses include restricted movement, unusual position and twisted/ contorted postures in the work place which affects health. The consequences are purely physiological, that practically remain sustained, over a period of service and surface only at a later period, when the damage done is irrevocable.

The quality of the environment has a great impact on the quality of health. When the air, water and other parts of the environmental life – support systems, are relatively clean, good health is easier to maintain. However, when one's life support system is poisoned with large amount of pollutants, toxic conditions can represent a health hazard.

### *A. Need for the Study*

Many occupations or ways of life carry the risk of particular diseases or disorders (Medical Encyclopedia, 1988). Employment in mines, quarries and industries potentially occupy the first place in this regard. The main feature of Andhra Pradesh economy is the domination of traditional industries – quarries and mines. There are 49 mines and 180 quarries with rich deposits of laterite, fine clay, china clay, rough stone,

gravel, sand and graphite. It provides employment to a maximum of female workers (45 per cent). Similarly Cashew processing occupies a prominent place in the industrial map of Kerala. It provides employment to a maximum number of female workers; approximately 1.65 lakh workers are employed among whom 95 per cent are women.

### *B. Nature of Employment*

Though they are highly labour intensive industries, reports point out that the standard of living and health status of these women laborers incidentally was found to deteriorate, lowering their socio-economic status, due to seasonal employment. As essential factors, the seasonal nature of employment and levels of wages largely determined the health status of the labour force. As increments they endured unhygienic environment, postural immobilization, occupational health hazards and varied psycho-social problems in the work place. Discriminations of female labour vis-à-vis male labour in employment, payment and working conditions were prevalent in these industries. Clear divisions of labour persist, which unloads all manual activities on women like shelling, peeling, grading and packing in the cashew industries and carrying load, cutting stones, sieving etc. for the other two groups.

Everything underground the mines belong to the domain of the principal employer and his workers are protected (Joseph, 1996). Every work on the surface is given out to contractors who hire casual labourers, majority of whom are women, who remain 'casual' throughout their lives, and are paid on piece rate basis. High incidences of casualisation of women are predominantly because of those engaged as contract workers. Insecurity of employment, low percentage of permanency, low wages, hazardous and strenuous nature of work and non-enforcement of labour laws strictly are the other problems women workers face in this sector.

The technology of cashew processing involves very little investment in plant and machinery. From open pan roasting – a very crude and unhygienic traditional method – the present widely adopted method of drum roasting and oil bath roasting (high investment oriented) constitutes only a small step forward. The nature and type of work (employment) account a lot to an individual if one has to lead a happy contented societal life. The manual labour performed by these workers creates a plethora of problems. The crude tools used, bad posture adopted, inadequate work space and long hours of work are potential factors which affect the workers. In addition to these spatial problems, there are the constraints of precision and speed which oblige the workers to maintain the same posture throughout the working day and impose considerable muscular stress resulting in localized aches and pains. All these contribute to the unorganized nature of these jobs.

## II. METHODOLOGY

Fifty samples comprising of 26 from mines and 24 from quarries were selected using purposive sampling (employment being seasonal). The areas chosen were three mines and the two quarries in East Godavari District in Andhra Pradesh. Five cashew factories located in Kollam district (Kerala) which promised support and 200 samples from them consisting of a uniform blend of shellers, peelers, graders and packers were selected for the study adopting purposive sampling. Methods of study involved a structural interview schedule and observation.

## III. RESULTS AND DISCUSSION

### *A. Work Profile*

The nature of the job they performed varied. Carrying load was the primary job among (100 cent) mineworkers; but in quarries cutting stones per cent) was the chief activity. Carrying load involved filling and carrying head loads of 10-15 kg each of stones or dust from mine/quarry site to the dump-yard or from dump yard to transportation area. This was a non-stop (continuous) process done from 8 am to 5 pm. Under sieving the samples separated the stones and dust into varied sizes using small sieves. The posture adopted (stooping) was the most awkward. While digging the samples dug the hard ground using crowbar and spade and under cutting or crushing stones large pieces of stones were hammered to small pieces. Each sample was allotted 3 tonnes of stones which they were supposed to hammer to small pieces in a week's time.Workers in the cashew industry were engaged in four types of jobs.

***Shelling***: The process involved breaking the roasted kernels using wooden mallets in a squatting posture for almost eight hours a day with the trunk and knee flexed, head lowered and eyes fixed on tl breaking stone. On an average they deshelled 7-8 kgs of kernels /day. The cleaning up process involved carrying a loaded basket on the head and balancing another with a co-worker.

***Peeling***: The work involved delicate peeling off of the peel of the kernel with their finger tips and nails. The posture adopted was sitting flat on the ground. They were found to shift position on and off.

***Grading***: The posture is almost similar to the peelers. The work involved close scrutiny to remove unwanted peels or cavities in the nuts using a metallic knife and grading them for quality.

***Packing***: This involved alternate standing, bending and lifting, and weighing and filling ten kg of nuts in containers, lifting them to the weighing balance, subsequent packing and sealing and transporting them to godowns. A worker packed 200-250 tonnes a day indicative of the mean number of times they changed posture and lifted such heavy weights.

The nature of employment was purely seasonal and the samples had to seek alternate employment every now and then. Their work timings were satisfactory, abiding by the stipulation put by the Factories Act 1948.

*B. Socio- economic Status*

The details on this aspect is presented in the following Table 1.The family background of the workers focused a very bleak picture. All of them were on temporary contract. The entry into service reportedly was between 15-20 years for quarry and cashew workers (62.5% 39.5%) and 21-25 years for mine workers (46.2 per cent).

TABLE 1: SOCIO ECONOMIC BACKGROUND

| Particulars | | Percent Responding | |
|---|---|---|---|
| | | Cashew industry | Mines/quarry |
| Caste/Religion | Hindu: | | |
| | Backward Class | 41.5 | 40 |
| | Schedule caste | 36.0 | 44 |
| | Christians | 17.5 | 16 |
| | Muslims | 5.0 | - |
| Family Type | Nuclear | 32.0 | 80.0 |
| | Joint | 68.0 | 20.0 |
| Marital Status | Married | 75.0 | 84 |
| | Widows | 18.5 | - |
| | Separated | 6.5 | - |
| | Single | - | 16 |
| Age of Workers | 15-20 | - | 20.0 |
| | 21-30 | 38.5 | 22.0 |
| | 31-40 | 38.0 | 38.0 |
| | 41-50 | 23.5 | 20.0 |
| Household size | 1-3 | - | 26.0 |
| | 3-5 | 30.0 | 30.0 |
| | 6-8 | 66.0 | 42.0 |
| | 9-11 | 4.0 | 2.0 |
| Number of Children | 1-3 | 26.0 | 26.0 |
| | 3-5 | 60.0 | 30.0 |
| | above 5 | 14.0 | 44.0 |
| Educational Level | Illiterate | - | 58.0 |
| | Functional literates | 30.0 | - |
| | Primary education | 57.5 | 28.0 |
| | High School | 12.5 | 14.0 |

Incidentally 37.5 per cent each among quarry workers reported that their total monthly family income was between Rs. 1001 – 1501/- and Rs.1501-2000/- respectively. Again among mine workers the range was only between Rs.500-1000/- (42%) and Rs.1001-1500/- (35%). Similarly cashew workers showed only a monthly income within the 1001 – 1500/- range (72%) with the rest earning only below Rs.1000/-. It was pathetic to show eight percent to have joined as cashew labourers before being 15 years of age.

*C. Wage Earned*

When they (mine/ quarry workers) worked in the site they were paid Rs.30/- a day, but if it was cutting stones they received a weekly wage packet of Rs.150/- and that too only if the task was completed. Among the four types of cashew industry workers, peelers ranked high in their wage status, despite being not provided with any tools. The weekly wages fell within the range of Rs.220-260/- during the study period.

*D. Physical Environment*

The physical environment in which they worked proved to be most arduous as they worked in the open or within a kutcha shed. Andhra Pradesh being the popular state for its record on very high ambient temperature ($37^0$C) and humidity the stress the labourers endured could very well be imagined. Monsoon times eventually were the most dreaded period by cashew workers.

*E. Tools Used*

The samples faced many risks from the tools they used for the jobs, namely, hammer, spade, shovel, crowbar, wooden mallets, metallic knife and the like. Similarly constant exposure to environmental stressors added more risks to life.

TABLE II: ENVIRONMENTAL AND OTHER STRESSORS

| Particulars | Percent Responding | |
|---|---|---|
| | Cashew Workers | Mines/ Quarry |
| Air Pollution | | |
| Dust | 100 | 100 |
| Smoke | 80 | 83 |
| Noise | 68 | 100 |
| Heat | 55 | - |
| Dry air | - | 100 |
| Humidity | - | 100 |
| Land Pollution | | |
| Cashew nut shell liquid | 90 | - |
| Stagnant water | 50 | - |
| Miscellaneous (solid wastes) | 50 | - |
| Sloped terrain | - | 100 |
| Water Pollution | | |
| Residual matters | 60 | 100 |
| Larvae | 46 | - |
| Algal components | 30 | - |

Almost 50 per cent of both quarry and mine labourers suffered headache, fatigue and blisters due to sun, while 40 per cent on an average suffered from pain in joints. Dry throat and watering eyes were the other risk factors which indirectly affected their performance. Cashew workers on the other hand suffered serious health problems (Table.III).

Cashew peelers suffered dermatitis/oedema etc, due to exposure of unprotected hands to cashew nut shell liquid (CNSL) which is a toxic irritant. Continued exposure can even lead to changes in haemotological parameters and toxic effects which affect skin, liver, heart/lung tissue and kidney in the future (Banerjee and Rao, 1992 and Usha and Prakasam, 2004)

The nature of work engaged in by all the three groups caused varied physical ailments like pain in different body parts, injuries, stiffness of muscles, arthritis, urinary tract infections, menstrual and uterus problems. Abortion was also experienced by 8.3 and 11.5 per cent of the quarry and mine labourers

respectively due to the strenuous jobs undertaken. All the workers were also prone to work related physiological fatigue.

Triggerers of physiological fatigue were uncomfortable posture, length of work period, intensity of the tasks, carrying load, enforced speed of action and precision required, muscular stress and unbearable climatic conditions.

*F. Posture*

Posture induced problems were also reportedly high.

TABLE III: OCCUPATIONAL HEALTH HAZARDS ENCOUNTERED

| Health Hazard | Percent Responding | | | | |
|---|---|---|---|---|---|
| | Shelling | Peeling | Grading | Packing | Mine/ Quarry |
| **Dust** | | | | | |
| Respiratory problem | 80 | 80 | 66 | 50 | 83 |
| Allergic reactions | 90 | 100 | 72 | 62 | 34 |
| Bronchitis | 56 | 82 | 76 | 20 | 92 |
| Asthma | 52 | 64 | 60 | 40 | - |
| Common Cold | 50 | 56 | 40 | 30 | - |
| Tuberculosis | 8 | 4 | 0 | 0 | 28 |
| **Smoke** | | | | | |
| Suffocation | 82 | 80 | 64 | 52 | 58 |
| Wheezing | 36 | 54 | 42 | 36 | 62 |
| Lungs infection | 6 | 4 | 0 | 0 | 64 |
| **Noise** | | | | | |
| Hearing disability | 100 | 0 | 0 | 100 | 30 |
| Irritation | 100 | 18 | 10 | 100 | 54 |
| Over stress | 100 | 8 | 10 | 100 | 89 |
| **Heat** | | | | | |
| Head ache | 80 | 48 | 16 | 20 | 100 |
| Nausea | 2 | 8 | 4 | 6 | 52 |
| Heat stroke | - | - | - | - | 100 |
| **Water** | | | | | |
| Skin allergies | 12 | 10 | 8 | 2 | 46 |
| Dysentery | 12 | 10 | 8 | 2 | 20 |
| Diarrhea | 8 | 2 | 4 | 2 | 60 |
| Fungal infection | - | - | - | - | 48 |
| **By-products(Extract)** | | | | | |
| Tanning of arms | 100 | 0 | 0 | 0 | - |
| Rashes | 100 | 100 | 0 | 0 | - |
| Oedematic fingers | 100 | 100 | 80 | 40 | - |
| Dermatitis | 100 | - | - | - | - |
| **Work Posture** | | | | | |
| Low back pain | 100 | 86 | 80 | 90 | 100 |
| Shoulder pain | 100 | 90 | 90 | 60 | 100 |
| Stiff neck | 84 | 96 | 90 | 60 | 80 |
| Arthritis | 88 | 68 | 60 | 86 | 75 |
| Back ache | 100 | 62 | 60 | 56 | 100 |
| Pain in the heels | 60 | 28 | 14 | 76 | 100 |
| Urinary infection | 36 | 24 | 20 | 0 | 50 |
| Uterus problems | 12 | 4 | 0 | 0 | 50 |
| Hernia | 6 | 0 | 2 | 0 | 20 |

All such activities involved static contractions. It is proved that static contraction of muscles definitely cause greater fatigue on muscles than dynamic contractions because of restricted blood flow and inherent oxygen depletion. During activity many of the muscles namely elbow, neck, abdomen, back, knee and ankle were flexed beyond tolerability. Naturally this led to stiffened muscles and persistent pain. Along with that the lumbo sacral-region underwent and contracted excessive compressive force which in the long run may cause fractures and damaged vertebral discs. These disorders develop only gradually. The sample did not even know about the damage they inflicted upon themselves

TABLE IV POSTURE ADOPTED

| Sector | Activity | Posture |
|---|---|---|
| Mine/Quarry | Carrying load | Bending, Standing and Walking |
| | Cutting/crushing stones | Standing, bending and Squatting |
| | Sieving | Alternate bending and straightening |
| | Digging | Alternate bending and straightening |
| Cashew Workers | Shelling | Squatting and bending |
| | Peeling | Squatting |
| | Grading | Squatting |
| | Packing | Alternate standing, bending, twisting and straightening |

*G. Drudgery*

The work related factors namely work overload, carrying 10-15 kgs per load of stones or dust and walking with load continuously for almost 8 hours, continuous hammering and the cluttering noise made while hammering, stooping and sieving for hours together and standing in an awkward sloppy terrain and digging the hard ground on par with men were the sources of severe drudgery for all labourers engaged in these activities. The time pressures imposed upon the labourers, job harassment, and frustration developed were the other work related factors which were focused as affecting their health status. The labourers likewise were not enlisted for any social security schemes.

*H. Psychological Impacts*

Numerous psychological factors with negative impacts emerged with regard to their places of work. The type and nature of work, work stability, service condition and job satisfaction affected the efficiency o the workers. The amount of working space, public conveniences, washing and other facilities were also pointed out as important factors lacking in their occupational work environment. Psychologically, monitoring of work, the terrain and monotony of the jobs were focused as fatigue and drudgery producing. In addition lacuna felt with all types of motivators namely recognition, freedom and interpersonal relationship also made them depressed and frustrated.

*I. Social Security*

In spite of all such sufferings endured, without any protection, it was shocking to hear that none of the samples enjoyed monetary benefits like bonus/ gratuity fund, holidays or maternity leave. The labourers likewise were not enlisted for any social security schemes. The social cost of occupational hazards is very high, but the estimated monetary cost of

eliminating every hazard is even higher. Knowingly, therefore, employers were found to allow the labourers to work in such adverse environments.

*J. The Living Environment*

This includes aspects like housing, sanitary surroundings and healthy habits. Provisions for water, lighting, sewage, roads, market and recreational concepts are human social facilities that are imperative to sound health. Together fundamental psychological needs of privacy, family life, avoidance of fatigue in household tasks, cleanliness etc should also be provided for better life. These again were found to be highly inadequate.

## IV. Inferences

The study revealed that all the samples were prone to WMSDs (Work related Musculo-Skeletal Disorders), life supporting system damages affecting respiratory systems and nervous systems and ergonomic problems.

## V. Conclusion

The studies, thus, revealed that these work environments contributed the least to safeguard the labourers occupational safety and health. Their living environments and family status too added to their misery. Yet their contribution to the family (economically, socially and structurally) and to the nation goes unregistered and is accorded least significance.

Only paid work is considered in the estimation of the Gross Domestic Product (GDP) of a given country (World Development Report, 1995). The under valuing of domestic work by society has serious implications. It ignores and makes invisible the contribution of women to the family income and hence its economic well-being. Its monetary value when performed in the market is very low. Their work is not counted and the labourers are not even considered as workers.

Incidentally earnings of female workers are an important and essential source of income, particularly, of the poor households. Millions of families in most parts of the globe largely depend on women's earnings. Yet, for the group studied, their socio economic status remains bleak and disarming. Low wages and job impermanency are not the direct causal factors. The societal framework which promotes male domination at home level and demands subservience, coupled with lower economic contributions to the family, their poor living conditions, drudgery, uneven sharing of family responsibilities and low nutritional status add to their work load, misery and added drudgery. They were found to be unprotected and enduring many occupation related health hazards. Naturally unorganized sector proves to be the kingpin milieu of safety and occupational health hazards.

## Recommendations

To be precise the women labourers studied, all endure high levels of physical, psychological and ergonomic discomforts. Even if, their earnings go unnoticed their 'human resource potential' can be recognized and can be enhanced by making provisions for ensuring safety and safeguarding their occupational health. Hence the following recommendations are put forth for Governmental/industrial interventions.

- Creating awareness among labourers on ergonomics through participatory ergonomics
- Provision of basic facilities and amenities, protective equipments and tools to ease work
- Assurance of job permanency and medical benefits
- Enhancing working environment ambience.

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# Ergonomics of Traditional Looms– Occupational Health Hazard Among Women Weavers

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*Abstract*—**Role of women in the cultural and socio economic life of Manipur is significant. Manipuri women regard handloom weaving as a religious tradition or a custom, than an occupation. Despite being the biggest industry in Manipur, they function only as small scale / cottage industries and expose these women weavers to all kinds of safety and work related health hazards typical of the unorganized sector. Weaving being the universal vocation among Manipuris, the ill effects of engaging in non-ergonomic weaving practices are accepted without showing much of an ado. The looms that they use, namely the throw shuttle, fly shuttle and the indigenous loin loom only aggravate the issues as they are used in unconducive work environments. The plight of such women just remains invisible even today. This paper projects the impact of these looms on the users in their typical work environments, specific to Manipur. The findings prove that the indigenous loin loom impacts the weavers more than the other two looms.**

***Keywords: Manipuri, unorganized sector, handloom, loin loom, traditional weaving***

## I. Introduction

Women as a part of the socio-economic system, as they uphold the rich cultural and traditional values and has a strong bond with the nation's progress. Their participation, therefore, in developmental activities of the societies has always called for concern. Weaving in Manipur was started with an emotional attachment since the women and girls wove only for their dear and near ones and in each of their products, they tried to express something of a personal emotion and communicate warm feelings through the fabrics,that were intended to be worn. Every Manipuri adult-woman wove for herself and her domestic consumption. The mother acted as the master craftsman in the family (1). As every household in Manipur owns a loom, women folk alone are weavers (2).In Manipur, because of the tradition in vogue and geographical isolations, entire textile operation is still considered as cent per cent women activity only. It is said a girl cannot be married unless she knows weaving and she carries her loom to her husband's house when the marriage is solemnized. However the type of loom used by various communities varied considerably (3). There are three types of loom used in Manipur. The impacts of each looms on the users are different in certain ways.

The handloom industry play's a vital role in India. Manipur is famous for handloom weaving. Handloom weaving is wholly in the hands of women in Manipur. There are three types of loom are used, the loom used are not ergonomically designed, women are suffering from many problems that hinders their development and one among those problems are design of loom they used. They required more research and help to develop their loom used.

## II. Results and Discussions

Results and discussions of the studies are presented below

### *A. Posture Adopted*

For performing the activities the samples were found to adopt different postures while working in different loom. While pre-loom activities required the samples to sit or squat, loom related activities made them sit and work. Posture-wise, all activities of all types of loom users were found to be highly demanding.

### *B. Ease in Handling Tools*

The beating stick of the loin loom was very heavy(2.0 kgs).Placing it alternately on the ground and raising it to beat the weave for closing was highly painful especially on the shoulders. Nine and six per cent of weavers using throw shuttle and fly shuttle loom also expressed that they were not comfortable with the tools, especially the spindles.

### *C. Work Related Bodily Discomforts Perceived*

Eighty four percent of the weavers stated to be suffering from physical musculo skeletal discomforts (acute or chronic) due to involvement in these vocations.

### *D. Work Induced Body Pain Endured*

Pain in the back, shoulder, and hands were mostly faced by a majority of loin loom weavers as they kept pulling the beating stick very forcefully while weaving.

As the pull force exerted was towards left and right with every alternate strike, and up and down movement (strike of the sword or beater) these syndromes were felt quite often which lasted longer. Repetitive motions, all the more, aggravated their problems. Throw shuttle loom users complained more of eye problems, back and neck pain as they mostly used fine threads and delicate designs for which they had to look down below carefully, compared to their counterparts. Swelling in the foot was also frequently felt, as their legs were kept hung for long time while weaving. As the knee was not supported, some also complained of swelling in the knees along with foot. Fly shuttle loom users suffered pain in the shoulder, wrist and hand due to the repetitive movement of hand to fly the shuttle and make closing of the yarns faster. As both the hands were put into motion in opposite directions they called for not only physical discomfort but also mental stress, as one wrong movement was bound to end up in a piece branded 'damaged' (wrong weave). This fear complex remained with all types of weavers. Hence the samples endured psychogenic stresses too. They were quite unaware of the occupational health hazards that they would land in, if they didn't take some preemptive measures at the earliest. An enquiry was made to find out if they at least knew the reasons for getting such pain and responses received were quite thought-provoking.

The causal factors for such discomforts or pain as perceived by the sample highlighted repetitive motion, posture, pressure (force) exerted, duration of work, and the work itself as strong contributors, culminating in various other health problems for the samples. hence ergonomic analysis by using suitable tool is required for finding out the degree and types of problem for each loom. following analysis shows the results:

## III. Ergonomic Analysis of the Samples

This study was conducted by using Corlett and Bishop (1976) body part discomfort scale. Different parts of the day was divided for identifying the discomfort of body parts and their degree of discomfort in different types of loom users

*Discomfort Perceived on the Loin Loom (LL):* After working and before lunch, loin loom users complained of pain and discomfort in the upper and lower arm, shoulder and lower back. Pain and discomfort in the leg, wrist, buttock and difficulty to breathe were also complained about. The graph highlights the body parts receiving higher discomfort rates. After lunch break, though the samples agreed that the pain in the neck, buttocks, legs and wrist subsided, ache in the upper arm, lower arm, shoulder, and lower back were not found to ease out completely after the break. Pain generally increased and by the end of the day it was at its peak in these concerned parts. The impact of the previous day's work as pain in the upper extremities, lower back and knee was reflected on the day's (days when the tool was administered) work. The samples happened to start the day's work itself with pain in those parts. A short tea break also was not much of a help to reduce their feelings of pain. Ultimately weaving on the loin loom was the cause for upper limb disorders and pain in the lower back and knees – the most vulnerable, yet important body parts of everybody. As the work was started and ended with pain, it is concluded that pain in these parts had become a part and parcel of the selected samples.

*Body Discomfort Felt on Throw Shuttle Loom (TSL):* The day's work itself was started with pain in the lower back and foot, eyes and upper arm, which gradually increased and reached the peak by evening. Though pain had tended to decrease slightly after small rest pauses, the samples really endured pain throughout the day and 24/7 hours. Among these, pain in the l back ranked high followed by shoulder. Eye sight was affected more among these weavers as they used fine fiber and delicate designs. Working after lunch break and before snacks too, ache in the shoulder and lower back recorded the highest score. A short break as tea time, even was not much helpful in relieving the samples from pain in the upper / lower arms, hip and wrist. As the working time advanced, the samples also started experiencing difficulty with breathing too. Another feature was the swelling in the foot which increased with the time of pedaling and posture adopted.

*Perceived Body Discomfort Vs Fly Shuttle Loom (FSL):* Unlike the other two groups, the fly shuttle loom weavers reported of pain in the chest and stomach along with the ache in the upper extremities. For this group too, incidence of pain was found to be gradually increasing as the time of day and the work time advanced. Here again, breaks in between work was or a temporary relief from pain. By evening like the oth... samples, this group too wound up the day with pain in the shoulders, arms and lower back. All these findings stand testimony to the fact that the samples in all the looms are eventually prone to work related musculoskeletal disorders (WMSDs) in the upper extremities and the lower back. Among them the worst hit were the loin loom weavers who recorded the highest score (above 40) for pain/discomfort in all their vulnerable regions.

*Mean Cumulative Body Discomfort Score for Weaving:* This aspect projects the mean cumulative score recorded for the impact of the job on all the 42 selected samples (14 each using three types of looms respectively), and the perception of pain /discomfort in different parts of the body while performing in the looms. The data is presented under Table (1)

This analysis enabled identifying the body parts which were mainly involved in weaving operations and

# Occupational Health and Safety-Plight of Women in Construction Industry

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***Abstract*—Women constitute around 25 per cent of the 402 million-strong work force in India, with 94 per cent of the work force in the unorganized sector - in agriculture and allied activities, construction, transport, mining, manufacturing, small and medium enterprises and as contract labour. Construction is a physically demanding occupation, but a vital part of our nation. As increasing numbers of women enter the construction trade, concerns about their health and safety are growing. In addition to the primary safety and health hazards faced by all construction workers, there are safety and health issues specific to female construction workers. This large workforce handle tasks that range from carrying heavy loads to performing repetitive tasks, placing them at risk of serious injury. Today, nearly 60 per cent of women aged 16 and over participate in the workforce. As the terms "occupational safety and health" imply, there are two aspects to this field. One is the area of safety, which seeks to make workplaces safe for workers so that they do not suffer injuries. Poorly designed or laid-out workplaces or equipment pose a serious hazard to workers and more than 400,000 injuries occur at work each year. Separate from the concept of safety is that of occupational health, where the goal is to prevent the occurrence of illnesses among workers because of exposures at their place of work. As safe work promotes an integrated multi-disciplinary approach, which takes into account the physical, mental and social well - being of women workers, in particular, need to identify such problems in the first instance receives priority. The article discusses the ground realities/conditions of these workers, safety hazards faced and the occupational health disorders endured. A few suggestions to mitigate these problems are also put forth to integrate occupational safety and health in the construction milieu.**

***Keywords*—Unorganized labour, women construction workers, safety and health issues***

## I. Introduction

Women constitute around 25 per cent of the 402 million-strong work force in India, with 94 per cent of the work force in the unorganized sector - in agriculture and allied activities, construction, transport, mining, manufacturing, small and medium enterprises and as contract labour. Construction is a physically demanding occupation, but a vital part of our nation. These workers are one of the most vulnerable segments of the unorganized sector. The construction workers are regarded as the prototype of extremely demanding jobs tagged as 3-D's: dirty, dangerous and difficult.

As increasing numbers of women enter the construction trade, concerns about their health and safety are growing. In addition to the primary safety and health hazards faced by all construction workers, there are safety and health issues specific to female construction workers. This large workforce handle tasks that range from carrying heavy loads to performing repetitive tasks, placing them at risk of serious injury. Today, nearly 60 per cent of women aged 16 and over participate in the workforce.

As the term "occupational safety and health" implies, there are two aspects to this field. One is the area of safety, which seeks to make workplaces safe for workers so that they do not suffer injuries. Poorly designed or laid-out workplaces or equipment may pose a serious hazard to workers, and more than 400,000 injuries occur at work each year. Separate from the concept of safety is that of occupational health, where the goal is to prevent the occurrence of illnesses among workers because of exposures at their place of work. Safe work promotes an integrated multi-disciplinary approach, which takes into account the physical, mental and social well - being of men and women workers. Conceiving the working conditions and the working environment as a whole, the prevention and control of work-related factors and their multiple and cumulative effects are taken into account including psycho-social and organizational aspects.

### *A. Unorganized Labour In Construction Industry*

The first National Commission on Labour (1966-69) defined unorganized labour as those who have not been able to organize themselves in pursuit of common objectives on account of constraints like casual nature of employment, ignorance and illiteracy, small and scattered size of establishments and position of power enjoyed by employers because of the nature of industry etc. Nearly 20 years later the National Commission on Rural Labour (NCRL: 1987-91) visualised the same scenario and the same contributory factors leading to the present status of unorganized rural labour in India.

*B. Indian Construction Industry-Overview*

| Year | Total Employment in Construction (millions) | Organized (sector) construction (millions) | Unorganized (sector) construction (millions) |
|---|---|---|---|
| 1993-1994 | 12 | 1.2 | 10.7 |
| 1999-2000 | 17.2 | 1.2 | 16 |
| 2004-2005 | 25.7 | 1 | 24.7 |

Source: Sen Krishna Nirmalya (construction industry in India-Safety and health perspective 2009)

*C. Global Scenario*

Each year, an estimated two million women and men die as a result of occupational accidents and work-related diseases. Across the globe, there are some 270 million occupational accidents and 160 million work-related diseases each year. Construction workers form 7.5 per cent of the world labor strength 16.4 per cent of fatal occupational accidents account to construction Industry. Construction workers are exposed to serious occupational health and safety hazards. Construction, as a major employment generator in many parts of the world, construction is also a sector associated with a proportionately high number of job-related accidents and diseases. Despite mechanization, the industry is still largely labour-intensive, while working environments are frequently changing and involve many different parties. The industry also has a long tradition of employing migrant farm labour from lower-wage economies and of much employment is precarious and short-term. According to ILO estimates, each year there are at least 60,000 fatal accidents on construction sites around the world. There is one fatal accident every ten minutes, one in every six fatal accidents at work occurs on a construction site, in industrialized countries, as many as 25 to 40 per cent of work-related deaths occur in the construction sites, even though the sector employs only 6 to 10 per cent of the workforce, in some countries, it is estimated that 30 per cent of construction workers suffer from back pains or other musculoskeletal disorders.

## II. Methodology

A micro level study of 500 construction workers (women) deployed by 70 promoters in Coimbatore city were interviewed by using structured interview schedule. The highlights of the findings are presented below:

Construction is a labour oriented industry; most of the workers have migrated from different states to other states in India which has now become so rampant that its impact is felt in every aspect of life. Migration had become a way of life to many, who are unskilled and semi skilled and find difficult to get better jobs within their native place and locality. The Study presently reported of in around Coimbatore city also proves that these migrant workers are spread across the width and length of Coimbatore city. From among 500 construction worker 92 per cent were migrant workers. They travel from one area of work to other area along with their families and live in a place, which is either provided by the owner of the construction company or somewhere near by, building temporary shelters. They have maximum mobility because of the nature of their work. These labourers are engaged in huge industrial constructions, residential flat constructions, city beautification works and the like.

These construction labourers, as a part of unorganized work force remain the most exploited ones even after five decades of independence. (www.indianmba.com). In the recent past the trend had shown all big construction companies to have become the centres to recruit casual labourers as construction labourers and promoters in Coimbatore city are in no way different from other. Their lack of education and skill (labourers) make their choice very limited. Wl they come to big cities, they have to face number problems because of their inexperience and lack of skill. They become easy victim of exploitation and have to work for their day today sustenance. As a result, the safety culture among them is also low and making them understand the importance of safe working methods is a tough task. The current study revealed that the knowledge of the basic safety norms to be adopted in their work by the workers was very low. When they handle hazardous material in their work, their knowledge of the after effects of mechanical handling and/or of chemical was used almost nil. They were not aware of their right to a conducive environment and facilities to carry out their work safely and so were being exploited by their employers. Since the workers' are not habituated in using personal protective equipment, they were reluctant to use it on their own. However, 20 per cent alone did adopt safe working methods due to compulsory use of personal protective equipment at some sites. There are legislations t ensure a conducive work environment for the safety o people engaged in construction work, but these lack effective implementation. The workers were also exposed to hazardous substances which have the potential to cause serious occupational diseases such as silicosis, lead poisoning, asbestosis, dermatitis and cancer. Potential for disasters due to collapse of structures, scaffolds and subsidence of soil on which the construction activities are carried out also cannot be ignored. However, the awareness was found to be negligible among the construction sample.

*A. Reflection on Status Quo of Women Construction Workers in Coimbatore City-Why and how?*

- Workers mostly comprised of landless labourers moving to cities in search of works, where they were exploited by contractors.

- Workers were exploited because they were socially backward, unorganized, uninformed, and poor. Moreover their work was also characterized by its casual nature, temporary relationship between employers and employees, lack of basic amenities and inadequacy of welfare facilities. The extent of unionization in the construction industry being very low due to migratory and seasonal nature of workers and scattered location of work sites, added to their plight.
- Workers were found to be unorganized and incapable to bargain on the issue of welfare and Social protection.
- Workers were exposed to scorching heat, rain, cold dust molten materials etc. A good 40 per cent were exposed to the risks of workplace accidents and occupation problems about which they were reluctant to talk about. The workers were also exposed to host of substances, which have potential to cause serious health disorders like asbestosis, and other occupational diseases of the respiratory system and digestive system.
- They lived in huts or under canvas, where no sanitary facilities and crèche facilities are available. Children of all ages were brought along with them to the worksites.
- Social protection was virtually non-existent due to lack of stable nexus between employee and employers and irregular duration of work. Wages in the industry were at large a minimum or at a sub-minimum level. Women and children were paid wages at comparatively low rates than what men were paid. Whatever work they do, women were paid between Rs.120/ to Rs.150/ a day while men were paid Rs.300/ to Rs.350 per day. 'Gender Discrimination' in terms of tasks entrusted and wages given was highly distinct. Similarly system of invisible bondage exists and was found to extend from one generation to the next child labour.

Working Environment And Work-Related Hazards

*B. Workplace Culture*

The construction industry has been overwhelmingly male dominated for years, and on many jobsites women construction workers were not welcome. Sex discrimination and anti-women attitudes still prevailed on worksites, despite the fact that gender discrimination is illegal. Literature searches show that female construction workers suffer from gender and sexual harassment, a factor associated with low job satisfaction as well as psychological and physiological health symptoms and workplace injuries but the covered sample was reluctant to disclose these facts.

Fear of losing the job and facing humiliation, these workers did not even freely express their grievances.

*C. Sanitary Facilities*

Access to sanitary facilities was frequently a problem on a new construction site and temporary facilities which were usually unisex, often without privacy, and generally not very well maintained were observed. In some sites the women were not provided with any sanitary facilities available, especially in a newly constructed house site. Agony of those special days for women they receives a special mention here. In some places even availability of portable water for drinking was not ensured.

*D. Stress*

Stress is a work-related disease of multicausal origin. It can be defined as a physical or physiological stimulus which produces strain or disruption of the individual's normal physiological equilibrium. The most frequent disorders range from chronic fatigue to depression by way of insomnia, anxiety, migraine, emotional upsets, stomach ulcers, allergies, skin disorders, lumbago and rheumatic attacks, tobacco and alcohol abuse, heart attacks and even suicide. Excepting the last all the samples were found to be in stressed. One of the major causes of stress was fear of unknown situations and lack of control over the duties to be carried out and over the organization of work. Lack of command over the local language was a major stress buster. These workers were thus deprived of personal initiative and were doomed to endure monotonous and repetitive tasks.

Overall status they are exposed to hazardous chemicals which have carcinogenic and mutagenic effects. Studies conducted showed that jobs like lifting, carrying, pulling, pushing, screwing drywell, sieving sand, and doing overhead work prevailed as branded tasks for women in this sector proving the existing belief on feminization of these jobs.

Stress was aggravated by the fear of losing a job, relationship problems, sexual harassment, discrimination, or other non-occupational factors, such as family problems, multiple roles, health anxieties, commuting and financial worries. Typical women's jobs in this sector proved that these women had much less control over decision making in the activities than typical men's jobs. In various occasions they were oriented to tasks which required less strength, more agility, more speed, attention and precision; characteristics socially associated with a female personality.The concentration of women in these types of jobs, their specific working conditions, including being more frequently subjects of sexual harassment and discrimination, as well as their major responsibility for family care and household work readily determine the higher prevalence of stress-related disorders in women.

It is evident that stereotyping of jobs and feminization of jobs prevail in the construction industry. There is no room for development, job options, learned decision making or job alternatives all lead to an inertia and stress in the workers. These aspects reiterate the casualisation, feminization and discrimination prevailing among construction workers. Being branded as casual or contractual labourers, their dream of a 'future' remains only as a dream.

*E. Occupational Health Hazards*

Most injuries in construction workers are sprains and strains of the muscles. Construction work can also cause injuries to the joints, bones, and nerves. These injuries often occur from constant wear and tear on the body. Taken together these injuries are called musculoskeletal disorders. Generally, musculoskeletal disorders in construction workers affect the hand and wrist, the shoulders, neck and upper back, the low back, and the hips and knees.

Workers who must often lift, stoop, kneel, twist, grip, stretch, reach overhead, or work in other awkward positions to do a job are at risk of developing work and posture – related musculoskeletal disorders and ortho problems. These problems among women workers is all the more prominent, but invisible. These include back (spinal) problems, carpal tunnel syndrome, tendinitis, rotator cuff tears, sprains and strains of various types. These problems do not surface but stay invisible as these women and their socio-economic status demand them to earn. Studies conducted had shown, A good number (91%) of workers complained of pain in different body parts. The main complaints concerned low back pain (80%), neck pain (88%) and shoulder pain (89%). The causes are the workers awkward postures and heavy workload. Other health complaints involving gynaecological problems (56%), skin diseases (25%) and respiratory problems (32%) were also recognized. The body mass index mostly for the migrated workers reveals that 48% of them suffer from chronic energy deficiency. In addition to physical workload and awkward postures, the female labourers are exposed to dust, intense heat of the sun, biological pathogens, etc. The labour contractors do not provide any protective devices, nor do they take any responsibility for injuries or health problems at the worksite. Most of the female workers are also barefoot. They use no protective devices against heat, dust, etc.

*New Technologies*

New changes in economic structures and technologies have created new hazards and stress for such working populations. While the former in terms of casuality of labour questions job security, the latter always poses the threat of displacements for instance mechanical concrete laying, leaves women without a job. When machines come in, the first to lose jobs are women workers as they are considered the least skilled. They invariably do only digging and manual head-loading works on construction sites and are the most expendable. In fact, the work they do has been tremendously undervalued. There are some special legislative provisions to protect the interest of construction workers, such as The Building and Other Construction Workers (Regulations of Employment and Conduction of Service) Act, 1996, the Factories Act, 1948, the Contract Labour Act, 1970, Equal Remuneration Act, 1975, the Inter State Migrant Labourers of Employment Conditions of Service Act, 1979. Construction workers do not get benefit under the Employees State Insurance Act 1948, but are covered by the Workman Compensation Act, 1923. Employees normally prefer to avoid implementing, though the industry employs sizeable women workers (largely unskilled). The Maternity Benefits Act 1961 applies but the number of benefits is likely to be limited due to t intermittent nature of employment.

*F. What Can Be Done?*

Passing of legislations alone doesn't take care of everything. The enforcement agencies must intensify its implementation in the practical aspects. There is a need for a unified legislation on construction workers that must provide an independent enforcement authority for its enforcement at State as well as distract level. Labour welfare and social security measures have to be drafted to protect and promote interests of construction workers:

*G. Measures To Integrate The Perspective In The Field Of Occupational Safety And Health*

Protective legislation this is being carried out in five stages

*H. Women Labour Cell*

A separate Cell for women labour, which was set up in 1975, is functioning in the Ministry to pay special attention to the problems of women labour. The Cell is responsible for the following task:

- Coordinating effort in respect of Women labour within the policy framework on women drawn by Ministry of Women and Child Development–the Nodal department on the issue.
- Work in conjunction with Ministry of Women and Child Development and provide useful inputs on women workforce for effective formulation of Programmes and Policies on the subject.
- Implementation of the Equal Remuneration Act, i.e., its extension to various employments/Industries and examination of the difficulties, if any, pointed out by the units/Industries.

- Setting up of Advisory Committee for promotion of employment of women under the Equal Remuneration Act, 1976 and providing secretariat assistance to the Committee.
- Follow up action on the Supreme Court Judgment in the matter of prevention of sexual harassment of women at their work place and periodical reviews of the initiatives taken in the matter in consultation with related agencies viz. National Commission for Women, Ministry of Women and Child Development, National Labour Institute, etc.
- (vi)The Cell is also administering a grants-in-aid Scheme for providing financial assistance to organization (voluntary and non-government) for taking up action programmes/projects for the benefit of women labour.b) Equal Remuneration Act, 1976 , c) Committee to deal with complaints on sexual, Harassment of women workers, d) An Occupational Safety and Health Policy, e) Ergonomic considerations

Ergonomics tries to come up with solutions to make sure workers stay safe, comfortable, and productive. Ergonomics is a new topic for the construction industry, but the ideas have been around for many years. Ergonomics is now a well recognized discipline and constitute an integral part of any advanced occupational health services. The term "Ergonomics" is derived from the Greek ergon meaning work and nomos meaning law. It simply means "fitting the job to the worker" Training in ergonomics involves designing of machines, tools, equipment and manufacturing processes, layout of the places of work, methods of work and environment in order to achieve greater efficiency of both man and machine. The object of ergonomics is "achieve the best mutual adjustment of man and his work, for the improvement of human efficiency and well being". The application of ergonomics has made significant contribution to reducing industrial accidents and to the over all health efficiency of the workers.

The concept of maximum weight to be manually handled by women and the design of personal protective equipment need to be revised in the context of current technical knowledge and socio-medical trends. Intra-sex variations need to be taken into account. National standards for manual handling should move away from regulating weight limits which differ between women and men workers and adopt a non discriminatory approach based on individual risk assessment and control. Australia, Canada, and the USA are some of the countries, which have introduced these criteria in their own standards. With the worldwide massive migration, it is becoming more and more evident that anthropometric standards need to base on human variability more than on "model" populations, as different racial and ethnical morphological characteristics can be found among the workers of any single country.

A safety culture needs to be developed as an integral part of the work culture. The supervisors should brief workers every day before commencement of work on risk factors involved and precaution to be taken while working. Safety equipments like helmets etc must be provided by the employers. One Safety officer should also be appointed where 150 or more workers are employed.

Studies conducted in and around Coimbatore city also run on parallel lines. The impetus here is not on the load carried per se but the posture adopted, repetitive tasks (stooping to fill the pan, raising, walking almost 30-50ft again unloading the pan and returning back to load the pan for the next round) and the number of times these tasks (50 times in a day or more as required). They were found to carry almost 25kg in every head load. These processes involve rapid, repetitive motions of the wrist, hand and arms which can provoke repetitive trauma disorders and other musculoskeletal health impairments. The action may not sound actually strenuous but will weaken the muscles, tendons and joints due to repetitive conditions and non ergonomic work pattern leading to work related musculoskeletal disorders (WMSDs). These problems do not surface but stay invisible as these women and their socio-economic status demand them to earn.

Studies conducted in Coimbatore have proved the predominance of migrated workers in the industry, therefore these aspects has to be dealt with more caution and dexterity.

## III. Conclusion

The construction industry as a whole cannot afford to overlook the genuine safety and health needs and concerns of female construction workers. The dire need to call attention to the real contemporary health and safety issues of women in this industry, thus gains significance. These issues merit attention to and action by, all those who share responsibility in the arena of construction safety and health, and warrant a comprehensive approach by enlisting all those who have a stake in the industry. Simple changes can make a big difference as NIOSH (National Institute of Occupational Safety and Health) believes that better work practices and tools can reduce the frequency and seriousness of sprains and strains among construction workers.

Stereotyping, casualisation and feminization of labour existing in the construction industry coupled with gender discrimination and occupational risks and hazards, leave these women worker engaged in this industry totally 'excluded'. This state of affairs had to be faced with positive alternatives. Practicing

inclusiveness, Ergonomics and health promotion can prove beneficial. When ergonomic changes are introduced into the workplace or job site, they should always be accompanied by worker training on how to work safely. As ILO Director General Juan Somavia has stated, "Decent Work must be Safe Work, and we are a long way from achieving that goal."

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# Impact of Injuries in Women-Prospects for Ergonomic Intervention

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*Abstract*—**Injuries are a major public health problem in India which also has a definitive causative pattern and mechanism. Every year, injuries contribute to a significant number of deaths, disabilities, amputations, disfigurement, pain, suffering and agony. Identifying issues and problems in the occupational health of women remains a challenge. Any accident/injury to the hand or leg which throws a prospect of decreased efficiency in the present occupation and hinder in other types of work must be considered serious. Injuries due to occupational accidents lead to serious consequences in terms of both clinical courses and economic losses. The causes of injuries can be road traffic injuries, occupational injuries, fire-related injuries, fall, domestic injuries, and violence. The impact of injuries on the general well being is reflected in terms of economic, social, psychological, physiological distresses in the victim.This in turn will reflect as the performance limitation in both the occupational and domestic settings. Absence of emergency and trauma care, inadequate care combined with various dangerous home remedies aggravate injuries and complications, especially in rural areas. Rehabilitation forms an integral part of overall trauma care. Low-cost walking-aid equipment as prosthesis with ergonomic perspective should be readily available for use in community centres. Ergonomic intervention to induce confidence in their life styles should also be attempted. Appropriate use of these techniques along with social support systems for employment, education and home care would be of help to many disabled persons and help to improve their quality of life. This paper presents the findings of a micro level study conducted on a sample of injured women in Coimbatore city.**

***Keywords: Injuries, Rehabilitation, Ergonomic Intervention, Prosthesis***

## I. Introduction

India is passing through major socio demographic, epidemiological, and technological changes which have made it witness rapid urbanization, motorization, industrialization development, with mechanization and revolution in technology (*Sheth2005)*. This has altered the traditional ways of living and also the health scenario. Such recent progress in industrialization and use of vehicles, increased number of people living in crowded & unsafe settlements, coupled with inaccessible & unaffordable emergency health services also contribute to the higher health burden of injury in the developing regions of the world. These have contributed to the unprecedented upsurge of injuries. Injuries are a major public health problem in India. Every year, injuries contribute to a significant number of deaths, hospitalizations (for short and long periods), emergency care, disabilities (physical, social and psychological), amputations, disfigurement, pain, suffering and agony. In addition, injuries also result in disruption of several activities leading to loss of work, income, education and other social activities, causing long-term suffering among survivors and families.(Agarwal 1978) A precise understanding of this mechanism is crucial to develop and implement mechanisms for prevention and control of injuries. Rehabilitation forms an integral part of overall trauma care. Restoring an individual to his optimum level of functioning, reducing impairments and handicaps, and improving the quality of life are the essential goals of this programme. Appropriate use of techniques along with social support systems would be of help to many disabled persons to improve their quality of life (Hla Pe 1988).These aspects warranted an investigation.

## II. Methodology

A study was conducted to find out the extent of injuries and rehabilitation efforts undertaken. The purpose of this retrospective study was to investigate the epidemiology and general characteristics of the amputees to assist in future planning of prosthetic services and to identify the possible ergonomic technique that could contribute towards attainment of improved quality of life. This study was carried out in a few famous hospitals of Coimbatore. It was selected randomly and the casualty cases of the hospital consisting of 19685 patients were studied for the year 2010. The methodology adopted here are interview schedule and direct personal survey.

### *A. The Study*

Data recorded from an amputee intake form, maintained at the selected hospitals for all new admissions with the common characteristics dealing with age, sex, height, weight, education, marital and vocational status were obtained. In addition, the onset and date of amputation, cause and site of amputation, the length, shape and condition of the stump and range

of joint motions were also found. Information on prosthetic prescription, duration of prosthetic fabrication, status of check-out and overall period of prosthetic rehabilitation were also deduced.

*1. Number of amputees*

The population under study comprised of 19,685 patients, out of which 15,035 were male and 4650 were female. The 15-45 year age-group had the highest population with 10,250 persons (52.07%). A total of 735 amputations had occurred in one year in the total population. Incidence density was calculated to be 4 amputations per hundred people-per year of observation. Amongst male (31.4%), maximum number of amputations occurred in the 20-30 year age group. Female (49.38%) met with the amputations in their 30-40 year age group. Only 10.4% cases were above 60-year age group.

*2. Aetiology*

Majority of amputations were due to Trauma (55%) being the leading cause, followed by disease (32.45%) and congenital (12.55%) reasons. Trauma (86.87%) was the main cause of upper limb amputations. In the lower limb amputations both trauma (46.86%) and disease (40.58%) appeared to be almost equally responsible. Out of 36 multiple limb amputees' trauma was the cause for 59 per-cents. In congenital, lower limb amputees (76.3%) were most predominant. Specific causes of trauma were considered under "railway", "road" and "domestic/farm/ industrial" accidents; and "cut" injuries. Farm and industrial accidents were actual work related injuries, whereas domestic accidents were those sustained by individuals falling from trees and huts/houses, and injuries received during pursuit of their personal livelihood. Specific causes of disease were considered under "gangrene", "bone and joint infection", "leprosy", "tumour" and "vascular disease". Specific causes of amputation analysed against five different age groups are: Among the trauma amputees (59.9. %) the most affected age groups were 20-30years of age. (30%) Patients of 30-40 age groups were amputated due to domestic/farm/industrial accident. Among 238 disease amputees 41-60 age groups (42.05%) were primarily involved, followed by 21-40 age groups (38.45%). Within the 41-60 age groups the specific causes of amputation, were, gangrene (52%), vascular disease (23%) and leprosy (14%).Congenital amputees usually came forward for assistance between 11-20 years of age (46% ) and before 10 years of age (54% )surfaced

*3. Levels of amputation*

Among the 735 amputees there were (65.03%) lower limb, upper limb (30.06%) and 36 multiple limbs (4.89%) amputees. The levels of amputation are: below knee (30 %); followed by above-knee (20%), below-elbow (9%) and above elbow (7%) amputations. Among leg amputee partial foot amputation (8%) - (Chopart, Lisfranc, Ray) and ankle disarticulation (7%) (Syme, Pyrogoff) were reported. With regard to the arm amputation of digits (10%) and metacarpal amputation (4%) reported

*4. Impact of injuries*

Economic impact: An injured person has to spend resources for care at different levels and can be enormous. The rehabilitation costs were huge in certain types of injuries such as road traffic injuries, burn injuries and work-related injuries. No insurance coverage is offered for rehabilitation Damage to goods had led to repair costs based on the extent of damage. Work absenteeism-an inevitable outcome-leads to loss of productivity and indirect losses to the employ People after lower or upper limb amputation h problems relating to returning to work and working. Return to work rate is about 66% (43.5% after lower limb amputation and 53% for people after upper limb amputation).Almost 67 per-cents people after lower limb amputation retained the same occupation following amputation. After upper limb amputation (80%) have to change it. Post-amputation jobs generally more complex with a requirement for a higher level of general educational development and are being physically less demanding jobs were spelt out as major problems

Social impact: Majority of the survivors experienced life-long psychosocial impact and had a poor quality of life, as society keeps overt as well as covert discrimination with them. They often experienced discrimination in some form: in the workplace, from general public and from their kinfolk and relatives. Majority of the patients completely changed their activities and only few were interested i the same activities as before. They had even changed their recreational pursuits

Psychological impact: Amputee patients, who had experienced longer hospital lengths of stay, were diagnosed depressed. This had suggested that scores on a depression scale could be positively correlated with longer hospital length of stay, which will be taken up in the later part of the study. Amputees reported more significantly problems with mobility, social isolation, lethargy, pain, sleep and emotional disturbance. Other impacts include depression, anxiety, crying spells, insomnia, and loss of appetite, suicidal ideas and psychotic behaviour.

## III. REHABILITATION

Rehabilitation forms an integral part of overall trauma care. Factors to be considered with various areas of amputation with are as given below

The Upper Limb: The functional capacity of the upper limb is determined by the shoulder complex, elbow, wrist, and hand developing multiple integrated spheres of action. Given the normal proportion of limb segments, this capacity is limited in relation to the surrounding space.

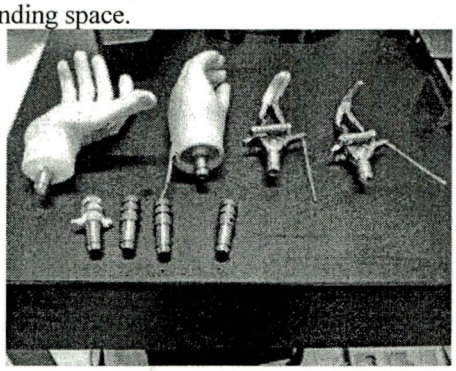

Fig. 1: Prosthetic Wrist Unit

The Lower Limb: The three components of walking-progression, standing stability, and energy conservation-involve distinct functional patterns. There are two main progressional forces: The primary one is forward fall of the body weight.The second, which is generated by the contra lateral swinging limb, starts with the onset of single-limb support.

Standing Stability: Balance is challenged by two factors. The body is top-heavy, and walking continually alters segment alignment. During walking the body divides itself into two functional units-passenger and locomotor. The head, arms, and trunk are the *passenger* unit because they are carried rather than directly contributing to the act of walking. The *locomotor* unit consists of two limbs joined by the intervening pelvis.

Energy Conservation: The basic measure of efficiency is energy expenditure per task performed. For walking, this is oxygen used per meter travelled. Oxygen is consumed as the muscles contract. Thus efficiency is improved by reducing the amount of muscular effort required to walk. This normally is accomplished by two mechanisms: momentum is substituted for muscle action wherever possible, and displacement of the body from the line of progression is minimized.(Durbadal Biswas etal, 2010)

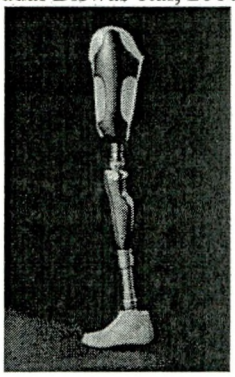

Fig. 2: Prosthetic Limb

Five joints in each limb (hip, knee, ankle, subtalar, and metatarsophalangeal), under the selective control of 28 major muscles, coordinate their actions to provide continual progression and weight-bearing stability with minimal displacement of the body's centre of gravity. To meet these demands each limb performs eight motion patterns that have been identified as the phases of gait.

*1. Musculoskeletal Complications in Amputees*

Amputee management has the added dimension of complications related to the amputation-prosthesis interface. The complications of amputation surgery can therefore be divided into pre prosthetic and post-prosthetic problems

*Pre prosthetic Problems: (1)* Delayed healing, (2) Skin Adherence to Bone of the Residual Limb.(3)Problems in Shaping of the Residual Limb.(4) Contractures.

Post prosthetic Complications: (1) Painful Residual Limb. (2)

Adherence of Skin to Bone (3) Insensitive Skin,(4) Poor Fit:

(5)Degenerative Arthritis (6).Fracture (Sunder, 2010)

*2. Prosthetic problems*

A pilot survey of prosthetic problems for sample 500 patients was undertaken. Prosthesis was fitted for 405 patients and 95 amputee patients did not opt for the prosthesis due to financial constrain. Survey was undertaken for 100 female patients who had traumatic amputations over last year regarding the problems faced by them in the fitting of the prosthesis. 26 per-cents responded that they had significant problems using their prostheses for work both domestic and other work. Most problems were related to pain (45%) and attachment method (55%).

There are significant problems with current methods for attaching prostheses that need to be addressed. Factors affecting were put forth and proved out as affecting their normal life were changes in Endurance (82%), walking downhill (78%), Recreation (75%),walking speed (65%), stability (42%), cosmesis (32%),and few reported that descending stairs was quite difficult (37%), Problems with fit (65%), appearance (54%), weight of the prosthesis (46%) were also reported.

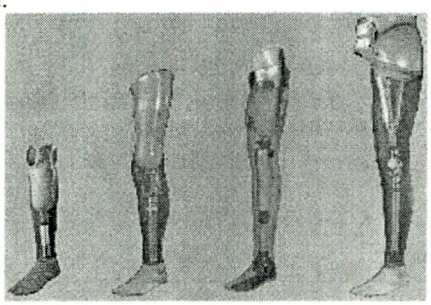

Fig. 3: Modular Lower Limb Prostheses

### *A. Tackling the Problem*

The study set out to uncover the multidimensional impact of these limb-threatening injuries. It was observed that the majority of disabilities were due to amputations. Amputations of the lower limb were more frequent than those of the upper limb. In the lower limb, motor car accidents were the main factors leading to amputation. In the study, very few cases of amputation were due to tumour or vascular impairment. In the present society Indian women do not confine to the home, like the men folk they are also more exposed to the external environment which may be the reason for the increased incidence of disability.

## IV. Conclusion

The majority of the causes of amputation is preventable and may be reduced by appropriate primary and secondary preventive measures. For these procedures to be effective, innovative community-based approaches should be employed as 80% of the population is rural inhabitants. In addition, research is needed to investigate the multiple deficits by an individual with partial absence requiring special attention when fitting a prosthetic system. Many of the amputees were neglected for as long as thirty-five years and, in many of the cases, revision of the stump was also required as bony projections, flabby musculature, contractures and sinuses were common. It was also observed that the conventional type of artificial limb did not suit the amputees from the villages. They needed an artificial limb which would permit them to walk bare-footed, allow them to squat and which would also permit them to sit in a cross-legged position. In addition these limbs should be ergonomic, economic, strong, simple, and easily repaired. So several improvements could be considered:

- It can be made known through education and publicity that disabled can be rehabilitated and can once more be independent and earning members of society.
- There should be more emphasis on the prevention of disabilities. Road safety campaigns could reduce car accidents and similar campaigns could be aimed at train accidents and industry accidents. Health education in diet and care of hands and/or feet; instructions in first-aid for minor injuries especially patients with diabetes mellitus should be undertaken.
- Encouragement of early management of the disabled should be undertaken as it would result in better rehabilitation as well as helping to prevent crippling complications.
- Immediate fitting of temporary artificial limbs to these amputees in the villages, while they awaited their permanent artificial limb, would help tremendously in boosting their morale as well as results in early gait training and improvement in muscle power.

Hence the future plans of the study are aimed at generating awareness among women on the benefit of the compatibility of the prosthesis and improving the existing prosthesis. Evaluating the outcome of access to women amputees and enlarge acc... to the same.

## Acknowledgment

I would like to thank and extend my gratitude to my Guide Dr. Visalakshi Rajeswari, Dr. Rajsabapathy, Dr. Bakthavasalam, Mr. Mohanty for their encouragement and support given to conduct this investigatory study, which is a baseline study for my doctoral research on "An Ergonomic Perspective in the accessibility of a prosthesis".

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the stress inflicted on them. Though the samples complained of pain in the neck, buttock, upper back, hip and wrist and swollen foot, the distress subsided during the lunch break. Pain in the shoulder, upper and lower arm, chest, stomach, lower back and knees was not found to ease out completely even after the break. Pain in the shoulder and lower back was found to be in the peak among all discomforts during the lunch break and even after the minimal rest. Evidently while resuming work after the break following lunch recess, all the samples were found to be enduring pain in the shoulder and upper arm followed by lower back, lower arm and knee.

TABLE 1: WEAVING VS MEAN CUMULATIVE SCORE FOR BODY DISCOMFORT

| Body Parts Affected | Mean Cumulative Scores for the Six Varied Times of the Day | | | | | |
|---|---|---|---|---|---|---|
| | BSW | AW/BL | ALB | AW/BS | AS | EoD |
| N | 0 | 0.09 | 0 | 0.21 | 0.11 | 0.23 |
| S | 0.13 | 1.4 | 0.35 | 1.6 | 0.72 | 1.89 |
| UA | 0.05 | 1.26 | 0.30 | 1.40 | 0.42 | 1.61 |
| LA | 0.04 | 0.78 | 0.19 | 0.92 | 0.54 | 1.16 |
| C | 0.02 | 0.07 | 0.08 | 0.21 | 0.08 | 0.21 |
| S | 0.01 | 0.04 | 0.04 | 0.07 | 0.2 | 0.07 |
| LB | 0.01 | 1.25 | 0.34 | 1.15 | 0.55 | 1.53 |
| B | 0.03 | 0.21 | 0 | 0.35 | 0.04 | 0.35 |
| K | 0.1 | 0.53 | 0.16 | 0.57 | 0.34 | 0.71 |
| L | 0 | 0.30 | 0.04 | 0.33 | 0.07 | 0.14 |
| F | 0 | 0.05 | 0 | 0.02 | 0.01 | 0.23 |
| E | 0.16 | 0.27 | 0.22 | 0.36 | 0.29 | 0.36 |
| UB | 0 | 0.04 | 0 | 0 | 0.04 | 0.07 |
| H | 0 | 0.01 | 0 | 0.02 | 0 | 0.04 |
| W | 0 | 0.11 | 0 | 0.1 | 0 | 0.07 |

Discomfort increased in all the body parts after lunch break while performing work. Difficulty to breathe, stomach ache and pain in the eye, chest, and buttocks were common complaints. But by the end of the day the samples disclosed that the pain had increased in their shoulder, upper and lower arm, shoulder, lower back, legs and knees in descending order. It is proved therefore that the shoulder, upper arm, lower arm and lower back were the body parts to suffer heavy impact due to weaving for all the samples.

Naturally by the end of the day all the sample weavers were found to be silent sufferers as they switched over to the task of domesticity immediately they vacated the loom, thus revealing that they faced the household chores a real drudgery after the days toil in the physically discomforting looms. Evidently, this multitasking, further added to the samples' poor health status.

*Work Time on Looms Vs Mean Cumulative Body Discomfort Score:* The cumulative score for body discomfort (all parts inclusive) based on work time of the day was done including scores for each type of loom during performance by weavers. The data is presented under the following Table (2).

This analysis 'per se' analysed the looms for their impact on weavers

This exercise enabled studying the cumulative pain / discomfort felt by the sample during each phase of performance of the day. The analysis also facilitated comparing the impact of performing on the three types of looms. Such a comparison revealed that, the body discomfort rate of the samples performing in the loin loom was more than that expressed by sample in the other two looms. The graph also reveals that all loom users (irrespective of the type of loom used) to be having body discomfort and pain. Nevertheless the rate of discomfort varied during different times of the day. This has also proved and singled out performing in the loin loom as the most strenuous, which can and will leave a major dent in the health status of the samples.

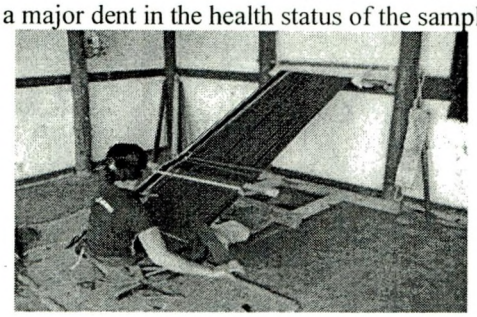

Fig. 1: Loin loom

TABLE 2: WORK TIME VS TOTAL BODY DISCOMFORT SCORE *VS* LOOMS

| Time of the day | Mean Cumulative Body Discomfort Score | | |
|---|---|---|---|
| | Type of loom | | |
| | LL | TSL | FSL |
| BSW | 0.85 | 0.82 | 0.17 |
| AW/BL | 9.0 | 6.0 | 4.14 |
| AL | 2.21 | 1.57 | 1.60 |
| AW/BS | 10.35 | 7.42 | 5.35 |
| AS | 5.28 | 3.35 | 1.85 |
| EoD | 11.64 | 8.07 | 7.0 |

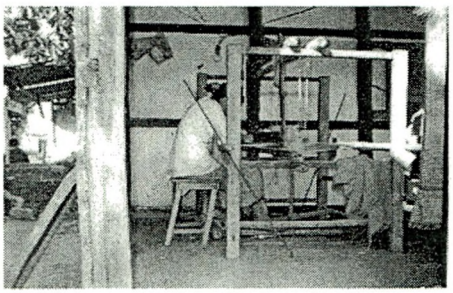

Fig. 2: Throw shuttle loom

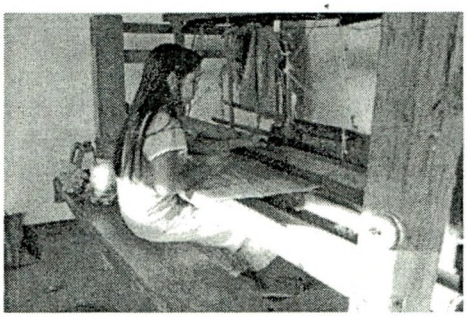

Fig. 3: Fly Shuttle Loom

## IV. Conclusion

Many aspects of human life constrain the quality of life despite the tremendous changes made in technology. Since quality of life is partly a function of the risks to life, the human community is still subject to a state of unhealthy. As a correlate, it is essential to know more about the limitations of performance and capacities of human beings. There has been a sustained interest in giving more systematic attention to the implications of the human factor in designing tools and equipments used in work performance. This general area of human endeavour, known as Human Factors Engineering or Ergonomics has evolved with the major objective of maintaining or enhancing human welfare (health, safety and satisfaction) and deals with one aspect of design of equipment, taking into consideration the operator's capacities, anthropometric data, limitations, comforts and compatibility.

## Acknowledgment

First and foremost, the investigator places her humble salutations at the feet of God almighty who has given sound wisdom, strength and opportunity to do the project work effectively. The candidate wholeheartedly acknowledges Dr. (Tmt) S. VISALAKSHI RAJESWARI, M.Sc., (Kerala), M.Phil (Bharathiar), Ph.D., (Avinashilingam), Professor, Department of Resource Management, Avinashilingam Deemed University for Women, Coimbatore, under whose unstained help she has been able to execute her research and complete it successfully. She records her most reverential gratitude to her for her imperative guidance, ameliorating efforts, patient assistance and constant encouragement throughout the study and preparation of this conference paper. Presenter wholeheartedly thanks to the organizers of this conference and acknowledge Michael Shell and other contributors for developing and maintaining the IEEE LaTeX style files which have been used in the preparation of this template

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