

OCCUPATIONAL STRESS, MUSCULOSKELETAL DISORDERS, HEALTH AND ILL-HEALTH EXPERIENCES OF INDIAN WORKING WOMEN: A REVIEW

Suman Mukhopadhyay¹, Vasundhara Pandey² and Tania Chakraborty²

*¹Assistant Professor, Ergonomics & Human Factors Engineering, National Institute of Industrial Engineering (NITIE), Mumbai 400 087

*²Fellow, Fellow Doctoral Programme, Ergonomics & Human Factors Engineering, National Institute of Industrial Engineering (NITIE), Mumbai 400 087

Email: suman_mukhopadhyay@nitie.edu

Abstract

Working women experience more work-family conflict than men, since they usually still retain primary responsibility for child-care, elder-care and for household chores. These myriad obligations associated with responsibilities at the workplace, causes significant physical or psychological stress in these women employees, affects their health and well being, and results in decline in work efficiency potential.

Besides these factors, menopause in women is associated with changes that may create considerable stress for some women, affecting their health, well being, identity, self-esteem, and social and family relationships.

The authors will discuss the findings based on several studies on the status of musculoskeletal disorders, Occupational stress, Quality of life and health & ill-health experience of Indian working women with respect to their occupations and reproductive stage. The studies assessed Occupational Stress Index, Quality of Life and Menopause Ratings were assessed. The results unanimously revealed that both eumenorrhic and postmenopausal working women reported similar occupational stress levels at "moderate". In several studies, no differences were found between the eumenorrhic and postmenopausal groups for other domains of quality of life, except for the physical health domain. A majority of women reported 'occasionally', for questions relating to spouse participation in household chores / childcare responsibilities and eldercare responsibilities. However, despite managing both home and work domains, a study on government officers of West Bengal did not bring out a significant difference in stress levels amongst male and female officers involved in similar work at office, suggesting that women may be better adapted at coping with stress, than men.

These studies equivocally conclude that menopause does not cause any significant impact on level of stress and quality of life, though it may be associated with or act as a precipitating and causal factor in heart discomfort and muscle and joint problem. Postmenopausal women were observed to be more prone to neck and knee pain than their eumenorrhic counterparts, for same workplace conditions and job profile.

Keywords: occupational stress, musculoskeletal disorders, ill-health, indian working women

MUSCULOSKELETAL DISORDER RISK FROM PERSONAL DIGITAL ASSISTANT AND LAPTOP USE: RESULTS OF A PILOT STUDY WITH A CONVENIENCE SAMPLE

Arijit K. Sengupta and Prakash Kothari

Department of Mechanical and Industrial Engineering,
New Jersey Institute of Technology, Newark, NJ, USA

Email: sengupta@njit.edu

Abstract

A 39-item questionnaire survey was administered among 34 PDA (personal digital assistant) users and 37 laptop users. The participants constituted a convenience sample from a group of business professionals and graduate students. Questionnaire items included frequency and duration of use, perception of design adequacy, wrist and neck angles adopted during use, presence of physical discomfort and health complaints associated with the use of these devices. In a separate laboratory experiment, electromyography (EMG) signals were recorded using surface electrodes from six hand and forearm muscles while two participants used a laptop for 30 minute word processing and one participant used a PDA for 15 minute typing e-mails.

Results: The reported average daily usages of PDA and laptop were 1.1 and 2.3 hours, respectively. Ninety-seven percent PDA users reported that they use laptop or desktop for an average of 5.1 hrs daily. In contrast, only 54% of laptop users use PDA for an average of 1.2 hours daily. In a numeric scale, 1 being poor and 5 being good, the average rating given for the keyboard design (in terms of size, spacing and pressure) was 3.1 by the PDA group and 4.0 by the laptop group. Among the keyboard design attributes, key spacing obtained the lowest average score of 2.6 from the PDA group. The average display design adequacy (in terms of size, resolution and color) scores were 3.7 for the PDA group and 4.1 for the laptop group. Among the screen design attributes, size of the screen received the lowest average score of 3.5 for the PDA group. Thirty percent of the PDA respondents reported that they assume a bent wrist ($>15^\circ$) during PDA use, 9% suffered wrist pain/discomfort after PDA use, with an average discomfort level of 2.7 in scale 1 – no discomfort and 5 – severe discomfort. For the laptop group, the corresponding figures were 65%, 38% and 3.5, respectively. Using a self-administered Finkelstein's test, which is a diagnostic test for DeQuervain's tenosynovitis, 39% and 51% from PDA and laptop groups, respectively reported a discomfort level of 2 or more in the wrist area. For the neck posture during the device use, 79% from the PDA group and 62% of the laptop group reported they assume flexed ($>15^\circ$) neck posture. Approximately 21% from both the groups reported neck discomfort, with an average severity of discomfort 2.5. Out of all respondents, one PDA user reported high level of discomfort in hand-forearm, which interfered with daily activity, but did not received medical treatment. The median frequency of the EMG for each of the muscle groups, dropped significantly between the first five minutes and the last five minutes of the test, for both PDA and laptop use, indicating muscle fatigue from the experimental task.

Conclusions: Extensive use of keyboards generates static muscle stress in hand-arm-neck region (Szeto and Lee 2002), and the survey shows that with the advent PDA, the daily keyboard use is significantly increasing. The preliminary EMG analysis shows distinct muscle fatigue from 15-30 minutes continuous keyboarding, and muscle fatigue is believed to be a precursor of musculoskeletal disorders. Small key spacing and small size visual display of PDA can put more static strain on hand-arm and neck muscles, compared to those in conventional laptop or desktop work. PDA use within this cohort was associated with self-reported physical discomfort. Results suggest a need for more extensive study, including longitudinal surveys.

Keywords: musculoskeletal disorder, personal digital assistant, laptop

**AN ERGONOMIC EVALUATION OF WORK LOAD OF NURSES IN DIFFERENT
SHIFTS IN GENERAL HOSPITALS IN WEST BENGAL**

Subhashis Sahu

Department of Physiology, University of Kalyani

Kalyani, West Bengal Pin -741 235

Email: skcsahu@yahoo.co.in

Abstract

Present study aims at analyzing ergonomically the work load of nurses working in different shifts and finding out better ergonomic management, re-orientation and planning of the activities for greater efficiency in medical care. The study carried out in three government hospitals with very high intake of patients. The tasks performed by nurses in different shifts are divided into 20 types. The amount of time spent in each task was recorded throughout the shifts in activity analysis chart specially designed for this study. The perceived exertion rating and heart rate (by polar heart rate monitor.S810i, Finland) throughout the shifts were also recorded.

It was observed that the nature of job demand of nurses more in psycho-physiological domain rather than the physiological one. Only 26.8% of total working time spent by nurses in direct care throughout the day. Although time spend in different tasks differed in three shifts. The percentages of time spent by nurses in the morning shift in indirect patient care were more than those of the time spent in the other two shifts. Leisure time is more in the night shift compared to other two shifts but duration of shift is too long (11 to 12 hours)

Some recommendations, like ergonomic orientation of layouts of departments, arrangement of activities, ergonomic way of keeping the records and use of proper communication system, etc., will reduce the stress of work

Key words: Activity analysis, shift work, health care units, nurses

TEACHING ERGONOMICS TO EVERYONE

S. Darius Gnanaraj

Director – School of Mechanical Sciences & Dean
Karunya University, Coimbatore 641 114, Tamil Nadu, India.
Email: director_ms@karunya.edu

Abstract

Ergonomics is a common subject to many disciplines of Engineering. A subject known as 'Computer Workstation Ergonomics' is developed and it covers important topics such as the anatomical and mechanical structure of the human body, how the mind works, and designing for special population.

This subject is offered as a free elective and students from circuit branches, engineering branches and from life sciences opt for this and learn the principles of ergonomics as applicable to computer workstations. This paper presents the details of topics covered through this subject.

Suitable examples are given on how the topics are explained to students. This subject is successfully taught to the second year B.Tech students of Karunya University.

The details of class mini projects carried out by students by conducting ergonomic assessments of various computer workstations in our university are presented.

Keywords: Ergonomics, Computer Workstations, Checklist, human body, human mind

**HAND ARM VIBRATION SYNDROME: ERGONOMIC
ASSESSMENT AND PATHOPHYSIOLOGY**

Subrata Ghosh, Devashish Sen, Alok Kumar Syamal,
Bijetri Bandyopadhyay and Souvik Biswas
Department of Physiology, Presidency College Kolkata .
Email: subgh64@yahoo.co.in

Abstract

Ergonomic Risk assessment of Hand Arm Vibration Syndrome has been done time and again with respect to Occupational Health Management. In search of early indicator of its pathophysiological status, a number of specified and newer experimental tools are developed that would enrich the conventioned ergonomic assessment and compliment that double blind study including 40 male subjects were carried out . 30 male subjects with age group of 25 to 35 years, who are exposed to occupational hand arm vibration syndrome for atleast 5 years are taken as subjects. 15 comparable, unexposed male subject group are treated as control. Other that BMI, muscle strength, etc a newer tests like Cold Provocation, Lacrementation study, Nail fold Capillaroscopy, Retinal vasculature study and Capillaroscopy and BMD were performed with all the subjects.

All data were statistically analysed by Minitab Softwar 11.05 version 2007. Results showed that significant detrimental changes are there in Capillary arbonization of the exposed group. BMD changes are concluded to be delayed parameter. Peripheral blood flow and Tear breakup time, both are affected due to occupational vibration significantly.

Keywords: HAVS, Capillaroscopy, BMD, Occupational hazards

ERGONOMICS IN WORKPLACE

M. R. Premalatha

Professor and Head, Department of Family Resource Management,

Home Science College and

Research Institute, Tamil Nadu Agricultural University, Madurai

Email: premasivah@yahoo.co.in

Abstract

Ergonomics is expected to provide practical measures to prevent work – related injuries and deaths by addressing common factors, such as manual workloads, excessive stress, human error or poor work organization.

Though the concept of Ergonomics / Human factors is well understood and put into practice in large industries, small scale and cottage industries are yet to realise the importance of practicing ergonomics. There are a wide range of problems including those related to safety, occupational health, productivity and labour turnover in majority of the workplaces, where in knowledge in ergonomics will be of assistance. Ergonomics must be seen as a provider of solutions rather than the identifier of problems. Though several attempts have been made by educational, research and consultancy agencies to advocate ergonomics in work environment, fruitful results of implementation have not been obtained to the desired extent. The effective way of implementing ergonomics at workplaces is to emphasize economic returns in the promotion and justification of health and safety challenges in the workplace. The increasing use of economic benefit in support of ergonomics will definitely pave way for effective implementation even in the informal sector.

This can also be combined with participatory approaches as such as WISE (Work Improvement in Small Enterprises), WIND (Work Improvement in Neighbourhood Development) and WISH (Work Improvement for Safe Home) which have yielded good results in small and medium Enterprises, and among farmers and home workers in other countries. Such participatory approaches will help in mitigating occupational health hazards among the workers in different work environments.

Keywords: Ergonomics, workplaces, WIND, WISH

INFORMAL INDUSTRIES: DEVELOPMENT OF OHS MANAGEMENT

Anjali Nag

Deputy Director
National Institute of Occupational Health
Ahmedabad
Email: anjalinag@yahoo.co.in

Millions of workers (365m) have been employed in estimated 3.5 million unregistered small enterprises, including the farming sector in India. In this vast informal sector, situation will remain an implied challenge for effective OSH transfer and development because of non-existence of OSH services.

Case studies of small enterprises like sewing machine operation, fish processing, weaving, beedi rolling, ceramic industries, agarbatti making, and ironwork elucidate the issues and challenges surrounding the development of the OSH management in informal sectors. Health and environmental hazards, accident frequency, knowledge of safety at work, the OSH law obligations, the human resources and the management functions indicate an alarming scenario. Monotonous, & repetitive work, inclement working conditions, unregulated work hours, non-existent of welfare & health services and lack of management and training for OSH, are prevalent in this sector. Analysis showed the presence of several provisions concerning the enabling steps towards improved OSH management.

The existing national OSH laws and management models do not exclude small enterprises and informal sectors; however, the absence of long-term links between the constituents (governments, employers, workers, and workplace players) is the primary bottleneck in structuring contextual programs and systems. Small step progress is indispensable, subject to evolving national OSH policy frameworks tailoring in the line of ILO-OSH model.

This might be possible through local infra-structure extensions, such as block development, primary health services, public network building on good OSH practices, external support and economic incentives, training at all levels and through development of electronic surveillance system (e-tools).

Keywords: informal sectors, OHS management, electronic surveillance system

MITIGATING HINDRANCE IN POPULARIZING PRACTICE OF ERGONOMICS IN INDIAN INDUSTRIES *

Dr. T. Pachal

Occupational Health Services Centre, Bokaro Steel Plant, Jharkhand, India

Email: dr_tpachal@yahoo.com

Abstract

In India, a tangible growth has been observed in the field of Academic Ergonomics in last few decades whereas for a long period Industrial Ergonomics concentrated only in few heavy industries namely BHEL, SAIL, TISCO etc. The main hindrance in popularizing Ergonomics in Indian industries is that, though it closely resemble with Safety & Industrial Engineering which are essential part of a Production System, but in major Indian Industry, Ergonomics is being practiced as a part of Services activities; mainly with Occupational Health services which are definitely less focused than the main Production activities. Moreover, practicing ergonomics in industry is a group effort rather than individual job of a lone Ergonomist. As a matter of fact, most of the Ergonomics Projects go beyond implementation.

As a practicing Ergonomist for the last two decades in SAIL, it is felt that there exists a fundamental difference between Managing Ergonomics in industry and doing Academic Research. Solution of every ergonomics problem is unique and varies from shop to shop, industry to industry. An Ergonomist must have basic understanding on various industrial processes as well as substantial depth in Safety & Occupational Health. Industrial managements must not have any doubts regarding credibility of the Ergonomist on implementing viable productive projects. A positive evaluation on existing Ergonomics course contents both for UG & PG along with incorporation of Industrial training may augment the scenario.

The article will narrate several aspects of multi-professional approach on implementing ergonomics project in Steel Industry which may be positive inputs in the field of Academic Ergonomics in India.

Keywords: Ergonomics practice, Industry, Hindrance, multi-professional, Projects

EVALUATION OF VDT WORKSTATION – AN ERGONOMIC APPROACH

Rauf Iqbal

Assistant Professor, National Institute of Industrial Engineering, Mumbai 400 087, INDIA.

Email: rauf_iq@yahoo.com

Abstract

The last two decades have witnessed a rapidly accelerating trend toward the application of Visual Display Terminal (VDT) technology for information management in the workplaces and homes, and a growing body of scientific community is in search of the implications of VDT use on the health and well-being of its users. A striking aspect of the research on this subject is the degree of conflict among reports regarding the type, magnitude, and causes of adverse changes in the health, comfort, and satisfaction of the VDT user. To date, various checklists have been developed which focus mainly on the physical ergonomic demands associated with VDT use. A few have placed strong emphasis on job content, psychosocial, and related operational-organizational factors in the evaluation of VDT work. It is important that the evaluation technique must address the problems of VDT operators, the contributions of both work and workplace design factors and their interactions.

The aim of the present approach was to design an evaluation technique of the VDT workstation that includes an uncomplicated and short checklist which gathers maximum information in minimum possible time on the issues like work practice, workstation, working posture, work environment and health related issues of the users and simplicity in analysis of the data. The evaluation technique also includes measurement of key workstation dimensions and dynamic anthropometry of the VDT users and its comparison with acceptable ranges/standards. The evaluation technique has been finalized after its application in various Indian industries/establishments and necessary modifications to make it user friendly and easy implementation.

Keywords: Visual Display Terminal, workstation, checklist, dynamic anthropometry.

WORK COMPATIBILITY MODEL FOR PERFORMANCE EVALUATION

S A Basha* and J Maiti**

*Research Scholar and **Associate Professor, Department of Industrial Engineering and Management, IIT Kharagpur, Kharagpur 721302, West Bengal, India

Email: jmaiti09@gmail.com

Abstract

Work compatibility model is a recently emerged concept developed by Genaidy and co-authors (2002 – 2009). In this paper, the concepts and possible applications are discussed. The terminologies used, conceptual model, and mathematical formulations as developed in the literature are explained.

The authors are in the opinions that the framework of work compatibility can be applied to any industrial as well as service sectors for evaluating performance and pinpointing possible improvement options. Future research scope is also highlighted in the paper.

Keywords: Work compatibility, work demand, work energizer, Genaidy and co-authors.

**ERGONOMIC PERFORMANCE OF A WORKSYSTEM: MEASUREMENT
METHODOLOGY AND ITS APPLICATION**

Pradip Kumar Ray

Department of Industrial Engineering and Management

Indian Institute of Technology Kharagpur

Kharagpur 721 302 India

Email: pkv@vgsom.iitkgp.ernet.in

Abstract

Use of an appropriate performance measurement system has been traditionally emphasized by all types of organizations. However, with the available measurement systems, ergonomic status of a worksystem cannot be assessed. Keeping in view that identification and assessment of the effective organizational variables toward the overall performance of a worksystem is the primary requirement, a comprehensive and generic ergonomic performance system, called Ergonomic Performance Indicator (EPI), has been designed and developed. Modelling a generic framework involving all relevant ergonomic factors is the essential first step and assessing the degree of ergonomic maturity against each identified factor is the next importance step in the use of EPI for a given worksystem.

The ergonomic factors to be considered in almost all situations or worksystems are related to four key aspects of worksystems, viz. human characteristics, physical workspace, physical environment, and organizational factors. While assessing the level of an ergonomic factor, three principal parameters, viz. work efficiency, operator safety, and working condition, need to be considered. Each of these parameters needs to be defined and interpreted in the widest possible sense during evaluation. In essence, the performance of any worksystem is a reflection of the joint effect of performance of its three components, viz. 'human', 'machine', and 'environment'.

It is reasonable to assume that for a worksystem to be capable of performing at its maximum level, each component must also contribute significantly and equally to the overall performance of the worksystem as a necessary condition for an acceptable worksystem. However, the central focus of ergonomics being the human(s) in a worksystem, the main consideration in the design of EPI is to measure and assess the state of and the effect on human(s) in the worksystem, as a sufficient condition for sustained ergonomic performance.

Keywords: ergonomic performance, worksystem, methodology

EMOTION IN ERGONOMIC DESIGN

Prof. Amit Ray

Emeritus Fellow

Indian Institute of Information Technology, Design & Manufacturing Jabalpur

Email: aray@iiitdm.in

Abstract

Human factor, which is gaining popularity among the design professionals and analysts is- 'human emotion'. The long lasting relationship with a product and a brand is only developed through emotional attachment.

Design process involves- *Functional and Non-functional Elements*. Human emotion and feelings are called 'non-function elements'. In most cases design explores various formal structural elements and principles that are related to *functional elements*, which are verified through ergonomic testing. However, in most cases the *non-functional elements* remain untouched or unaddressed since it is the most complex area that cannot be quantified by one single parameter or a methodology. Non-functional elements deal with *human emotions*. Such emotions, closely related to *cognition* and behavioural pattern are based on- *visual, tactile, auditory, taste and olfactory* senses.

The author envisages examining the influence of *non-functional* element in design consideration. The biometric data are widely accepted and closely related to every design process. However, the *non-functional* elements in ergonomic studies remain untouched. Increasingly the human emotion is considered as one of the most exciting areas in the design filed. Hence, the author strongly feels the scope of non-functional elements should be included as well in the design process and the ergonomic studies.

Keywords: emotion, ergonomics, design, cognition, behavioural pattern

ERGONOMICS IN DESIGN – PRESENT SCENARIO IN INDIA

Subir Das

Head, Industrial Design

National Institute of Design (NID) Paldi, Ahmedabad-380007, Gujarat, India

Email: subirdas38@yahoo.com

Abstract

For the last several years, to compete in the international market, Indian industries are given enough importance on “Design” and have started establishing their design wings as a part of their research and development activities. With a view to clearly identify the role that Designs could play to enhance the competitiveness of Indian industry, a National Design Policy has recently been announced by the Government of India in 2007. Though marketing, production, manufacturing, materials, aesthetics and cost factors are very important to the success of a product, users are always at the centre of the design process. As a result, fortunately appreciation, analysis and application of ergonomics are also happening at all stages of the design activity.

‘Ergonomics in design’ is essentially the study and application of ergonomics principles throughout the process of design to make it user friendly, safe and cost effective with a view to get optimal human performance. In USA and most of the European countries, ergonomics standards are in place to follow for designing consumer goods, office furniture, tools, etc. Whereas, in India there is no hard and fast rule for its application; still the subject is not getting enough support from the Government and that is why its application is not a must in industry or elsewhere.

The paper highlighted the present scenario of application of ergonomics in design and briefly describes the outcome of some of the design interventions carried out by one of the premier design institutes in India, where a number of industrial products were redesigned and developed based on ergonomics principles.

Keywords: Ergonomics, Design, Indian Industries

ERGONOMIC INTERVENTIONS FOR WOMEN IN AGRICULTURE

Sudesh Gandhi

Department of Family Resource Management, College of Home Science, CCS HAU,

Hisar-125004 Haryana, India

Email: sgandhi3@yahoo.com

Abstract

In India, about 70 per cent of the total female working force is involved in agricultural operations. About 60 per cent of agricultural operations like transplanting, weeding, harvesting, storage of grains are handled exclusively by women while in other jobs they share the work with men.

In spite of technological advancement in agriculture, the jobs attended by women remain more or less same. Underlining it, the work profile of women reveals that all their work is characterized by low productivity & drudgery. Many improved farm technologies had been developed in the past. But mostly the technologies developed are either gender-neutral or gender-biased for men and the development of capabilities of farm women are rarely considered. Women have quite different technological needs due to different type of work and their anthropometric measurements. Very limited efforts were made until past to improve the work techniques and technologies for farmwomen. Recently, the R&D institutions in the country have developed the tools and technologies to be used by women in various agricultural operations which would increase the work efficiency of the farm women and reduce their drudgery in agricultural activities.

This paper deals with technology developed/modified for the identified drudgery areas of the women in agriculture, which were further studied after its intervention and impact assessment on reduced drudgery & increased productivity. It is, therefore, necessary to equip our farm women with the appropriate technologies to enable them to do their work efficiently and became equal partners in agricultural production.

Keywords: Ergonomic interventions, work efficiency, appropriate technology

CLOD BREAKING ACTIVITY PERFORMED BY HILL FARM WOMEN – AN ERGONOMIC ASSESSMENT

Jatinder Kishtwaria and Aruna Rana

Department of Family Resource Management, College of Home Science,

CSK HPKV Palampur

Himachal Pradesh, India 176062

Email: jkishtwaria@yahoo.com

Abstract

In mountain areas of India, women's contribution to agriculture is far greater than that of men as they are the real subsistence farmers. Human power of women continues to be a significant component for digging, clod breaking, sowing, harvesting, threshing and cleaning for which traditional tools and implements are being used by them indiscriminately over time in different parts of the country.

Clod breaking was identified as one of the most important drudgery prone activity, thus, this study was conducted to assess the existing practice of clod breaking performed by rural women and to explore ways as to how the problem of drudgery can be overcome. Thus, focus was laid to (i) Compare the traditional and improved clod breaker on ergonomic parameters; (ii) To design, develop and test the new clod breaker and (iii) To conduct the acceptability trials of the clod breaker for adoption by the users.

The study was conducted on a representative sample of 30 mountain women involved in this activity from Sidhpur village of Kangra District of Himachal Pradesh. The sample was selected randomly. The ergonomic assessment was done to determine the workload of women in terms of physiological stress and musculo skeletal problems. The results depicted that visible reduction was observed in the average heart rate (T-117 bpm; I – 109 bpm) of respondents involved in performing the task with the improved tool. Notable difference was also observed in the area covered with the use of improved technology (T-138 sq.mt; I – 201 sq.mt) as compared to the existing tool.

The acceptability trials were conducted on the representative sample and the positive response was elicited regarding acceptance of tool by the users. Hence, it is suggested that the new tool should be multiplied and made available to the farm women at subsidized rates.

Keywords: Ergonomic, drudgery reduction, clod breaker, Mountain Women

HUMANIZING WORK AND WORK ENVIRONMENT IN INDIAN AGRICULTURE

K. Kathirvel

Professor and Research Engineer, AICRP on Ergonomics and safety in agriculture,
Dept.of Farm Machinery, Agricultural Engineering College & Research institute, TNAU,
Coimbatore.

Telephone: 0422 6611257; Mobile:09894723311; Fax: 0422 6611455

Email: kathirvel2006@gmail.com

Abstract

Application of ergonomics concepts into sustainable improvements in quality of life of rural farm workers can be primarily through improvement in farm equipment design, work space layout, working conditions, occupational health, safety and comfort. Increased productivity can be achieved through improvements.

Anthropometric data bank of male and female agricultural workers is created which can be used in the design of various farm implements and equipment with respect to anthropometric suitability for enhanced comfort of agricultural workers and it will be highly useful to achieve enhanced performance and efficiency of man-equipment system along with better comfort and safety of farm equipment and machinery operators. Ergonomic interventions in various farming operations have been made for enhanced comfort of the workers. Gender friendly equipment with ergo design features *viz.*, worker friendly 8 row direct paddy seeder, sugar cane harvesting knife and cono weeder, women friendly ergo refined equipment *viz.*, groundnut stripper, fertilizer broadcaster, sugarcane detrasher, finger type rotary weeders have been developed.

On the basis of machinery-wise proportion of incidents as well as incidence rates for different agricultural machines accident minimization models have been developed for major agricultural machines *viz.*, cane crushers, tractors, threshers and chaff cutters. Technologies *viz.*, ergo refined coconut tree climbing device, arecanut harvester, worker friendly arecanut stripper and arecanut dehusker have been developed to ensure the safety of the workers. For reducing the health risks of the farm machinery operators, antivibration device for tractor and power tillers have been developed.

Keywords: ergonomics, equipment design, work space layout, working conditions, occupational health

**DIVERSITY OF AGE AND GENDER IN COLLECTIVE ACTIVITY:
A WAY OF WORKERS HEALTH**

Sandrine Caroly

University of Grenoble- PACTE- BP 47- 38040 Grenoble cedex 09- France

Email:sandrine.caroly@upmf-grenoble.fr

Abstract

Work organization design should take into account characteristics of workers population (size, weight, age, sex, level of formation or experience) in order to prevent some consequences on workers health and also on companies' performance. Musculo-skeletal disorders and mental disorders good examples undesired consequences. One of the statements of this kind of approach consider workers as a "middle operator", rather young, man, in good health having physical ability during all the time. In the automotive industry or in the assembly sector, the MSD increase when the production processes, notably lean manufacturing, without adapting work situations to population's characteristics (age and seniority). In police officer work or healthcare sector, the *rota system* is mainly based on performance parameters and don't take into account the balance of domestic and paid workload to manage schedule.

Stressfull situations are increased when management and work organization don't consider difference between men and women. Otherwise, collective activity is a way to preserve health, notably when team is composed of a diversity of age and gender. The older employees develop professional skills and have knowledge about working conditions they experienced in the past. They can transmit their experiences to youngest, and provide good conditions for apprenticeship. In return, the young workers give their strengths in the physical activities, permitting to maintain the health of the oldest. Also both men and women can manage the risk working together and managing workload according to gender and personal characteristics. For e.g., providing condition for women to develop theirs skills in police task force questioned anterior rules and allow also helped their male colleagues man to change their point of view about job values and their activity. The aim of this lecture is therefore to show how mixed teams of different age and sex in collective activity are a resource for health of each one and for the vitality of the collective of workers.

Keywords: work organization, design, knowledge, management

ERGONOMIC INTERVENTIONS ON SHOP FLOOR

Shriram Madhukar Sane and Aditya Shirish Khutale,
Vishwakarma Institute of Technology, Pune 411037.
Email: shriram.sane@vit.edu

Abstract

Many a times on shop floor, Ergonomics is not given due importance and this leads to inappropriate and inefficient use of equipment.

As an example the authors studied the work related ergonomics in a medium scale unit at Satara, Maharashtra, involved in manufacturing press components. The equipment designed for standing posture needs to be used in seating posture due to the requirements of products and raw material. The OEMs do not consider this aspect while designing the equipment and hence Ergonomists have to intervene to make necessary modifications in the equipment to enhance the operator comfort through suitable modifications.

In this study, presses of ranging from 10 tons to 60 tons are considered. In the existing situation, operators were using stools which did not consider anthropometric data of the population. This was leading to discomfort to the operators as well as accidents on few occasions.

In order to overcome these, modification were suggested in the stool design based upon anthropometric data collected for about 650 subjects; to give proper foot support as well as proper seating height so as to have minimum discomfort to the arms, as well as eyes. This stool is also provided with a small back support so that back pain can be minimized as well as this support works as a Poka Yoke

Keywords: Equipment Design, Posture, Anthropometric Data, Discomfort, Accidents

LL - 19

PHYSIOLOGICAL WORKLOAD AND PERCEIVED EXERTION OF THE FEMALE LABOURERS IN CUTTING STALKS OF SORGHUM CROP

Renuka S. Salunke, Susheela P. Sawkar, Shashidhar. K.C, Rama K. Naik, Sumangala P.R and Ashalatha K.V.

Assistant Professor (Sr.Scale), Professor, Dean (HSc),

Professor, Professor and Assistant Profesor

Email: s_renuka@hotmail.com

Abstract

The Investigation was carried out to know the workload and perceived exertion of the female labourers in cutting stalks of sorghum crop in Dharwad district of Karnataka state .The stalks of sorghum crop was ergonomically evaluated by using traditional and three improved sickles by the 30 healthy female labourers of the mean age 29.03 years, height-151.53 cms and weight-48.30 kgs with the normal blood pressure, pulse rate and body temperature .

The mean working heart rate and energy expenditure was higher during cutting stalks with CIAE Bhopal sickle when compared with traditional and other improved sickles. Based on the mean working heart rate, cutting stalks of sorghum crop was classified as very heavy for CIAE Bhopal sickle and as heavy for traditional , I-108 and I-104 sickles. The majority of the female labourers (90%) expressed their exertion towards cutting stalks with CIAE Bhopal sickle as very heavy followed by I-108 (80%) , I- 104(53.33%) where as the traditional sickle was perceived as heavy by majority of the labourers .

Based on the physiological parameters and work out put, the improved I-104 sickle was found to be superior to traditional and other improved sickles Hence, I-104 sickle was recommended to cut the stalks with less energy and maximum out put in turn it can reduce the circulatory stress, physiological cost of work and increased the work efficiency in cutting stalks of sorghum crops.

Keyword: Working heart rate, energy expenditure, circulatory stress, sickles.

WAGES IN INFORMAL SECTOR AND OCCUPATIONAL HEALTH HAZARDS

Ishita Mukhopadhyay

Department of Economics, University of Calcutta, India

Email: imeco@caluniv.ac.in

Abstract

Informal sector has been known to exhibit occupational health hazards. ILO introduced the concept of decent work and social security norms for workers.

This paper questions the wage fixation norm in the case of informal sector workers. Wage fixation in microeconomic terms includes efficiency of worker in terms of labour productivity, but does not include occupational health hazards. There is scope of covering health hazards through worker's benefit schemes in the case of formal sector workers. But wage fixation in the case of informal sector does not provide the scope.

The scope of occupational health hazards has been widely discussed in the literature in the case of informal sector workers. However wage fixation has never tried to be inclusive of the social security indexing occupational health hazards. The paper looks at the literature of occupational health hazards of informal sector workers and also considers the resolutions of ILO and international organizations like World Bank and International Monetary Fund regarding informal sector wages. The paper then looks at Indian data of informal sector given by NSSO, India. The paper statistically verifies if wage disparity between different informal sector workers corresponds to disparity in intensity of labour employment in the sectors. Two sectors: leather and leather products and engineering industries in West Bengal are taken.

The proposition that is tested is that does more labour intensity in informal sector involves more wages? (The assumption is that more labour intensity means more quantum of occupational health hazards in hazardous occupations).

Keywords: informal sector, occupational health hazards, wages, NSSO, ILO

ERGONOMICS STUDY FOR BHARATANATYAM

Dr. Manas Chattopadhyay

Dancing is culturally patterned sequences of non verbal body movements that are purposeful, intentionally rhythmic and have aesthetic value in the eyes of those for whom the dancer is performing. In this study, attempt has been made to view and analyze BHARATANATYAM in the frame of Biological Ergonomics.

Bharata Natyam is mother art for most of other classical dance systems of India.

The word 'Bharata' means combination of BHAVA (Mood), RAGA (Melody) and TALA (Rhythmic Timing). Natyam means the combination of both dancing and acting. The Science of Bharata Natyam is thus composition of a series of enchanting combinations of three main elements of Bodily Gesture, namely the Limbs, the Whole Body and the Face. These three main components had to express between them one uniform whole in which speed, delicacy, symmetry, body control, versatility, eye expressions, facial expressions, thought, word and song followed in a natural stream of harmony.

Selected combinations of hand, leg and foot movements generate pattern of postures and hand gestures. Together with these, there are special foot, waist, neck and arm movements and hand gestures. Finally these are completed with whole body movements. Orientation of different parts of the body relative to each other and path of their movement are described in terms of curvilinear co-ordinates. Angular motion of different parts about joints is studied in terms of elegant technique for investigating the characteristics of rigid body motion. How knowledge of the kinematics of rigid bodies applied to human movement in the environment of music can explore the erection of mood is one of the interesting feature of this study.

Key Words: Bharata Natyam, Biological Ergonomics, Gestures, Body Motion

CATCH THEM YOUNG: A COMPARATIVE STUDY OF VARIOUS ANTHROPOMETRIC PROFILE OF FEMALE YOUNG SCHOOL CHILDREN

Devashish Sen, Subrata Ghosh, Alok Kumar Syamal, Bijetri Bandyopadhyay and Souvik Biswas.

Department of Physiology, Presidency College, Kolkata, India

Email: devashishsen_12yahoo.co.in,

Abstract

Anthropometric study is one of the primary areas that should be investigated while selecting talents for sports whether it is professional or recreational. Young children (pre-pubertal) show remarkable growth with very little age differences i.e. they undergo the most rapid growth compared to all other age groups.

The growth between boys and girls though appears to be apparently the same, close monitoring could depict contradictory results. There could easily be a pre-pubertal gender biasness of growth. Again, as they grow elder, their growth ratio could easily reflect the age where the maximum growth occurs. This study will help to identify the appropriate age in which impact training could be given.

A change in body growth can occur in children between ethnic groups depending upon occupation and environment. Thus this work was undertaken to give an apparent idea about the growth pattern of pre-pubertal school children coming from the same environmental conditions and socio-economic conditions.

Keywords: Anthropometry, Pre-pubertal Female, Growth pattern, Body indices.