Technology Enabled Ergonomic Design

2020

HWWE

Humanizing Work and Work Environment

Proceeding

18th International Conference on Humanizing Work and Work Environment

December 10th-12th, 2020

Editors

Dr. N. K. Rana

Dr. Shah Aqueel A.

Dr. Najmuddin Aamer

Prof. Mohammed Wasim Khan

H. J. THIM TRUST'S

THEEM COLLEGE OF ENGINEERING

A NAAC Accredited Institute

Village Betegaon, Chilhar Road, Boisar (E). Dist. Palghar, Maharashtra, INDIA

(02525) 284909 / 284927 | 7769916108 | Web : www.theemcoe.org

H. J. THIM TRUST'S

THEEM COLLEGE OF ENGINEERING

Approved By AICTE (New Delhi), Government of Maharashtra & DTE, Affiliated To University of Mumbai & MSBTE. Estd. 2009

18th International Conference

of

Indian Society of Ergonomics

on

Humanizing Work and Work Environment –

HWWE-2020

Organized By,
H. J. Thim Trust's

THEEM COLLEGE OF ENGINEERING

on

10th - 12th December, 2020

In Collaboration & Association with

International Ergonomic Association
(IEA)

Indian Society of Ergonomic (ISE)

&

Technical Collaboration

Springer Nature

Title: Proceedings-18th International Conference on Humanizing Work and Work Environment- HWWE 2020

Editors:

Dr. N.K Rana

Dr. Aqueel Ahmed Shah

Dr. Najmuddin Aamer

Prof. Mohammed Wasim Khan

Publisher: Self Publisher

Publisher: Theem College of Engineering, Boisar, Palghar Dist., India

Printer: e-Publication

Edition: I

ISBN: 978-93-5419-847-2

Haji Jamaluddin Thim

1908-1980

In the founding memory of our inspiration

Haji Jamaluddin Thim

H. J. Thim Trust's

THEEM COLLEGE OF ENGINEERING

Boisar

Affiliated to University of Mumbai & MSBTE

Approved by AICTE

Approved by Government of Maharashtra & DTE

Editorial Board

About The College

Theem College Of Engineering is promoted by the H.J.Thim Trust, which has been founded to educate and empower the youth who play a decisive role in shaping the destiny of the nation. The College is located at Boisar (East) in serene and tranquil surroundings and was established in the year 2009 with an objective to impart quality education to students in the field of Technology. Theem COE has emerged as the only Premier Engineering College in Boisar with an overall intake of 480 students in various fields of engineering. The college is offering graduate Engineering Program in,

- Computer Engineering
- Information Technology Engineering
- Electronics & Telecom Engineering
- Mechanical Engineering
- Civil Engineering
- Automobile Engineering
- Electrical Engineering
- Computer Engineering (AI & ML)

We also offer Diploma Engineering Program with 240 intakes in ,

- Computer Engineering
- Mechanical Engineering
- Civil Engineering
- Electrical Engineering

About The Conference

We are delighted and pleased to extend our cordial invitation to all delegates to the 18th Annual International Ergonomics Conference ‘Humanizing Work and Work Environment (HWWE) 2020 under the aegis of the Indian Society of Ergonomics (ISE) which will be organized by Theem College of Engineering, Boisar, Mumbai during 10th to 12th December, 2020 along with the meeting of BRICS member countries in the backdrop of conference. The focus of conference is to explore and discuss opportunities related to Ergonomics and Human Factors Engineering and provide a platform for knowledge exchange to students, researchers and Industrial participants from all over the globe.

Humanizing Work and Work Environment (HWWE) 2020 with the theme of "Technology Enabled Ergonomic Design" is a foremost and influential conference for participants to present their research and innovations, exchange of concepts and ideas, develop networking and collaboration with other premier institutes in the area of ergonomics and human factor engineering and will serve as a confluence of ideas to improve human life through technology enabled design. We hope that HWWE 2020 will be an excellent educational voyage.

A BRIEF ABOUT ORGANIZING COMMITTEES

CHIEF PATRON

Hon'ble Anwar Hussain Thim
Chairman, H. J.Thim Trust

PATRON

Hon'ble Dr. Shaukat Ali Shah
Secretary, H. J.Thim Trust

Hon'ble Mohd. Hussain J.
Trustee, H. J.Thim Trust

Hon'ble Sharif A.Thim
Trustee, H. J.Thim Trust

CONFERENCE CHAIR

Dr. N. K. Rana

CONFERENCE CO-CHAIR

Dr. Shah Aqueel Ahmad

CONVENORS

Dr. Najmuddin Aamer

Prof. M.A. Gulbarga

Prof. K.N. Attarde

Prof. Raees Ahmad

Committees

International Advisory Committee

Dr. Kathleen Moiser -
President, IEA
Dr. Jose Orlando Gomes -
Vice President and Treasurer, IEA
Dr. Yushi Fujita -
Past President, IEA
Dr. Wei Zhang -
Tsinghua University, China
Dr. Eric Min Yang Wang -
National Tsing Hua University
Dr. Rosemary Seva -
De La Salle University, Philippines
Dr. Eva Honeyman -
Israel
Dr. Andrew Thachar -
Univ. of Witwatersrand, South Africa
Dr. Andrew Todd -
Rhods University, South Africa
Dr. Rammohan V. Maikala
Inst.of safety,USA
Dr. IanNoy -
Assoc. of Canadian Ergonomics
Dr. Takashi Toriizuka -
NIHON University, Japan
Dr. Elina Parviainen -
Finland
Dr. Margaret Graf -
Switzerland
Dr. Ali Hosseini -
University of Tehran
Dr. Dinesh Hurreeram -
Univ. of Mauritius
Dr. Michelle Grech -
Univ. of Tasmania, Australia
Dr. Denis A Coelho -
Portugal
Dr. Alan Chan -
Hong Kong University
Dr. Shrawan Kumar -
University of Alberta,*Canada*
Dr. Alecsander Volosiuk -
Russia
Dr. Bernard J.Martin -
University of Michigan, USA
Dr. M.Affan Badar -
Indiana State University,USA

National Advisory Committee

Dr. A.K. Ganguly -
President, ISE
Dr. D. Majumdar -
Vice President, ISE
Dr. Debkumar Chakrabarti -
Vice President, ISE
Dr. P. K. Nag -
EX-Director, NIOSH
Dr. G.G. Ray -
Professor, IIT B, Mumbai
Dr. Prakash Dhara -
Secretary, ISE
Dr. Ray P. K. -
IIT, Kharagpur
Dr. Rauf Iqbal -
NITIE, Mumbai
Dr. Vivek Khanzode -
NITIE, Mumbai
Dr. Venkatesh Balasubramaniyan -
IIT Madras
Dr. A. Chakrabarti -
IISC, Bangalore
Dr. Madhusudan Pal -
DIPAS, New Delhi
Dr. Swati Pal -
IIT B, Mumbai
Dr. Somnath Gangopadhyay -
University of Calcutta
Dr. M .Mujammil -
Aligarh Muslim University
Dr. Abid Ali -
Aligarh Muslim University
Dr. K.K. Deepak -
AIIMS, New Delhi
Dr. Archana Bhatnagar -
SNDT Women's University, Mumbai
Dr. Manjit Kaur Chauhan -
SNDT Women's University, Mumbai
Dr. Ajita K. Singh -
Punjabi University, Patiala
Dr. Reena Walicha -
Godrej Boyce Ltd, Mumbai
Dr. Abdul Rahman -
APJ AKT University, Lukhnow

Local Managing Committee

Dr. Emily Ghosh
Prof. S. Vajahat Ali
Prof. M.S Balasubramani
Prof. Prashant Rathod
Prof. S. Amjad Ali
Prof. Khalil Pinjari
Prof. Zulfiquar Ahmad
Prof. Harshal Patil
Prof. Sayyad Layak
Prof. M. Wasim Khan
Prof. Faiz Mohd.Khan
Prof. Muhib A. Lambay
Prof. Surayya Shaikh
Prof. Ansar Shaikh
Prof. Syed Tazeem
Prof. Rahatullah Khan
Mrs. Hemlata J
Mr. Sumit Mhatre
Mr. M. Faizan
Mrs. Pratiksha Sankhe
Mrs. Sayli Pimple
Mr. Harshal Sankhe

Acknowledgments to the Reviewers Panel of HWWE-2020 Conference papers

Sr. No.	Name	Organization
1	Dr. Kathleen Moiser	President, IEA
2	Dr. Shrawan Kumar	University of Alberta, Canada
3	Dr. M Affan Badar	Indiana State University, USA
4	Dr. Anabela Carvalho Alves	University of Minho, Portugal
5	Dr. Jose Orlando Gomes	Vice President and Treasurer, IEA
6	Dr. Andrew Thachar	Univ. of Witwatersrand, South Africa
7	Dr. A.K. Ganguly	President, ISE
8	Dr. D. Majumdar	Vice President, ISE
9	Dr. Debkumar Chakrabarti	Vice President, ISE
10	Dr. Prakash Dhara	Secretary, ISE
11	Dr. Rauf Iqbal	NITIE, Mumbai
12	Dr. NK Rana	Theem College of Engineering, Boisar
13	Dr. Aqueel A Shah	Theem College of Engineering, Boisar
14	Dr. M .Mujammil	Aligarh Muslim University
15	Dr. Abid Ali	Aligarh Muslim University
16	Dr. Swati Pal	IIT B, Mumbai
17	Dr. Vivek Khanzode	NITIE Mumbai
18	Dr. Manjit Kaur Chauhan	SNDT Women's University
19	Dr. Ajita K. Singh	Punjabi University, Patiala
20	Prof. Mohammed Wasim Khan	Theem College of Engineering, Boisar
21	Dr. Syed Qutubuddin	PDA College of Engineering, Kalaburgi
22	Dr. Aqueel A Shah	Theem College of Engineering, Boisar
23	Dr. Zahoor Alam	CRF Lab, / Rajiv Gandhi Institute of Petroleum Technology, Amethi
24	Dr. Subhasis Sahoo	Kalyani University
25	Dr. Emily Gosh	Theem College of Engineering, Boisar
26	Dr. Sougata Karmakar	Indian Institute of Technology-IIT Guwahati
27	Prof. M.A. Gulbarga	Theem College of Engineering, Boisar
28	Dr. Deepti Majumdhar	Defence Institute of Physiology and Allied Sciences (DIPAS), Delhi
29	Dr. Naresh Kumar Chuneja	PAU, Ludhiana
30	Dr. Nandita Bhattacharrya	Indian Institute of Technology, Guwahati
31	Dr. Najmuddin Aamer	Theem College of Engineering, Boisar
32	Dr. Trinath Pachal	Bokaro Steel Plant
33	Dr. Varsha Karandikar	Vishwakarma Institute of Technology, Pune
34	Prof. KN Attarde	Theem College of Engineering, Boisar
35	Dr. Somnath Ganguli	University of Calcutta, Calcutta
36	Prof L P Singh	Industrial Engg Dept, NIT Jalandhar (Pb)
37	Dr. Archana Bhatnagar	SNDT Women’s University, Mumbai

List of Eminent Speakers at HWWE-2020 Conference

Day	Particulars	Name
10th Dec Day-1	**Plenary Session-1**	**Dr. Kathleen Mosier,** President, IEA
	Plenary Session-2	**Dr. A.K. Ganguly,** President, ISE
	Keynote Address-1	**Dr. Debkumar Chakrabarti** Vice President, ISE
	Keynote Address-2	**Dr. Andrew Thachar** Univ. of Witwatersrand, South Africa
	Keynote Address-3	**Dr. Anabela Carvalho Alves** University of Minho, Portugal
	Lead Lecture and Session Chair	**Dr. Rauf Iqbal** NITIE, Mumbai
	Lead Lecture and Session Chair	**Dr. Swati Pal** IIT B, Mumbai
	Lead Lecture and Session Chair	**Dr. Somnath Gangopadhyay** University of Culcutta
	Lead Lecture and Session Chair	**Dr. Sougata Karmakar** Indian Institute of Technology (IIT) Guwahati
11th Dec Day-2	Keynote Address-1	**Dr. Shrawan Kumar,** *University of Alberta*, Canada
	Keynote Address-2	**Dr. D. Majumdar** Vice President, ISE
	Keynote Address-3	**Dr. Ali Hosseini, Iran**
	Lead Lecture and Session Chair	**Dr. Prakash Dhara** Secretary, ISE
	Lead Lecture and Session Chair	**Dr. Qutubuddin S M** PDA College of Engineering, Kalaburgi
	Lead Lecture and Session Chair	**Prof. L P Singh** NIT Jalandhar (Pb)
	Lead Lecture and Session Chair	**Dr. Manjit Kaur Chauhan** SNDT Women's University
	Keynote Address-1	**Dr. Wei Zhang,** Tsinghua University, China
	Keynote Address-1	**Dr. Jose Orlando Gomes,** Vice President & Treasurer, IEA Brazil
12th Dec Day-3	Lead Lecture and Session Chair	**Dr. Abid Ali** AMU, Aligarh
	Lead Lecture and Session Chair	**Dr. Ajita K. Singh** Punjabi University, Patiala

PREFACE

The objective of conference is to inspire engineers, academicians to explore, integrate and evolve in the research direction through a forum. As all of us know that Technology is always a progressive phenomenon, the research can bring the remarkable transformation to cater for the society needs. To achieve this precious goal a International conference **"Humanizing Work and Work Environment-2020"** has been scheduled on **10th - 12th December 2020** at ***Theem College of Engineering, Boisa***r providing the best avenue for the publication of research and development.

The HWWE-2020 will surely facilitate the participants to present, discuss and publish their recent research results and approaches which can develops new ideas to achieve the needs of emerging industry.

Without an effective coordination and support from many individuals and institutions, it is not possible to organize such kind of facilitation center for the researchers though which they can present the genuine research work. I would like to express my hearty and sincere thanks to the speakers of invited talks and contributory paper presentations. I wish to acknowledge the time and efforts taken by the expert reviewers of the journal for carrying out review of papers. I also acknowledge to all the members of different committees and co-conveners who carried out a lot of work to make this conference, ***HWWE-2020*** a grand success. I wish all participants fruitful and effective interaction at the conference.

Thanks a lot

Dr. Shah Aqueel Ahmed

Convenor, HWWE- 2020

INDEX

Assessment of Physiological Strain in Male Food Grain Cultivators while Engaged in Manual Water Lifting Task During Paddy Cultivation Time in a Southern District of West Bengal

Ayan Chatterjee[1, 2*], Sandipan Chatterjee [1], Neepa Banerjee[3], Shankarashis Mukherjee[3]
[1]HPAFU, Department of Physiology, University of Calcutta (*corresponding author: ayan4189@yahoo.com)
[2]Guru Nanak Institutions, Telangana: 501506, Hyderabad, [3]PHAU, Department of Food and Nutrition, West Bengal State University, Kolkata 700 126, India, HPAFU- Human Performance Analytics and Facilitation Unit, PHAU- Public Health Analytics Unit

***Abstract*—**Rice is the staple food all over the World. Moreover, it is one of the versatile foods on the planet and can be prepared in many different ways. It is grown almost all the states of India; among them West Bengal ranks first in the country in terms of cultivation area production. Yet, the food grain cultivators are constrained to work manually all through the day irrespective of disparity in working situation existing in the working environment. In this backdrop, the present study has been undertaken to assess the physiological strain in male food grain cultivators' (age range 24 - 36 years) while engaged in manual water lifting task (It is generally used for lifting of water from unlined wells, stream or pond for irrigating small fields. It consists of a lever rod supported at a suitable point on a vertical post about which it can swing in vertical direction) during paddy cultivation time. The study was carried out in villages of Hooghly district during 'Aman' and 'Boro' type of paddy cultivation time. Basic information in terms of age (years), working experience (year), average working time (hr.day^{-1}) was recorded in a pre-designed schedule. Physical and physiological parameters were recorded. Indicators of thermal environmental condition i.e. ambient temperature (ºC), wet bulb temperature (ºC), globe temperature (ºC), and natural wet bulb temperature (ºC) was periodically noted in agricultural field during the working hours. Indicators of physiological strain in terms of peak heart rate (beats.min^{-1}), net cardiac cost (beats.min^{-1}), and estimated energy expenditure (kcal.min^{-1}) were calculated. Heaviness of work was also adjudged by using indicators of physiological strain. From the results, it was observed that food grain cultivators experienced 'heavy' to 'very heavy' category of physiological strain while engaged in manual water lifting task. Moreover, the magnitude of physiological strain was significantly higher during 'Aman' type of paddy cultivation time.

Key words: Paddy cultivation, working environment, WBGT, food group

Ergonomic Evaluation of Rubber Tapping Workers using Postural Ergonomic Risk Assessment

Abi Varghese[1,2], Vinay V. Panicker[3]
[1]Research Scholar, Department of Mechanical Engineering, National Institute of Technology Calicut, Kerala, India, [2]Assistant Professor, Department of Mechanical Engineering, Amal Jyothi College of Engineering, Kottayam, Kerala, India
(*(Corresponding Author: abi_p190099me@nitc.ac.in).
[3]Assistant Professor, Department of Mechanical Engineering, National Institute of Technology Calicut, Kerala, India

Abstract — The rubber tapping is a monotonous task involving cyclic operations by making incisions on more than 300 rubber trees every day. PERA is a body posture analysis tool to evaluate short cyclic work. Thus, this analysis tool is suitable to evaluate the rubber tapping process. The cyclic work involved in the rubber tapping can be divided into four tasks such as (i) Removal of latex cover from the channel, (ii) Incision on the channel (iii) Adjusting the collection cup, and (iv) Moving to the next rubber tree. A sample of ten rubber tappers has been selected for this study. Direct observation and video-based analysis of the body posture using PERA tool are adopted in this study. The overall PERA score of 8 or more for the work cycle, which is corresponding to a level of 'high risk'. Therefore, the body postures resulted by the tapping work are not acceptable and corrective actions are necessary. The analysis also reveals that the second task has been reported with the major score in the rubber tapping process. Hence preventative measures are to be suggested in order to prevent bad working.

Drudgery Reduction Through Use of Hand Held Fertilizer Applicator

P. Parimalam[1*], P. K Padmanaban[2], B. Nallakurumban[3], C. Swaminathan, R. Surya[1]
[1]Community Science College and Research Institute, Tamil Nadu Agricultural University, Madurai, Tamil Nadu, India
[2]Agricultural Engineering College and Research Institute, Tamil Nadu Agricultural University, Kumulur, Tamil Nadu
[3]Community Science College and Research Institute, Tamil Nadu Agricultural University, Madurai, Tamil Nadu,
[4]Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai, Tamil Nadu, India
(*Corresponding Author: parimalamkannan@hotmail.com)

***Abstract*—**The process of fertilization is one of the phase that is very important in improving the quality and quantity of crops. The tools/equipment available for several agricultural operations are primarily developed for male workers taking their anthropometric body dimensions and strength parameters, which is on higher side than that of body dimensions of women workers. Therefore, it results in lower efficiency and health problems to farm women while operating it. To reduce the drudgery, occupational health problem and increasing productivity ergonomically designed hand held fertilizer applicator have been developed taking anthropometric body dimensions of farm women. The designed hand held fertilizer applicator was evaluated among six farm women for crops namely onion and ground nut. The six subjects performed the activity using conventional method and using the designed hand held fertilizer applicator. Parameters such as time taken, heart rate and energy expenditure ware studied and the same was compared with conventional method. Physiological parameter including age, height and BMI of the subjects were recorded. The mean age of the subject was 46+3.2 years. Time taken to complete 10 meter ridge is 18.02 seconds and 13.25 seconds for conventional method and using hand held fertilizer applicator respectively. Study on energy expenditure indicated 11.45 kJ min-1 for conventional method and 9.41 kJ min-1 while using hand held fertilizer applicator. The Heart rate during conventional method of fertilizer application was 118 bts/min while it was 109 bts/min using fertilizer applicator. The results indicate a overall reduction of time by 26% and energy expenditure by 17.8%. Hence, this drudgery reducing women friendly tool can be used for fertilizer application

Quality Function Deployment: A Methodology for Testing Agriculture Sickle

Dr. Promilakrishna Chahal
[1]Assistant Scientist, Dept. of Family Resource Management, COHS, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana. (*Corresponding Author: promilakrishnachahal@hau.ac.in)

***Abstract*—** This study was conducted to propose an improvement in design of sickle based on farm women need. For the present study two resource centers were established, Mangali and Behbalpur villages (one in each) of Hisar district, Haryana, where improved sickles were kept for use purposes of farm women. After giving two days training on use and advantages of tool (sickle), sickle were given to 60 farm women (30 farm women from each village) who were found to be actively working in farm activities. Personal interview schedule was done with farm women to collect the data on use and performance of sickle. Data was analyzed by using quality function deployment (QFD) methodology. As per findings maximum no of the farm women (96.7%) were found to be using sickle in daily agriculture activities by using 1:00-1:30hrs in a day. Ten attributes of customer requirements (C1-C10) were identified and their correlation with technical attributes (T1-T10) was analyzed. As per findings most importance attributes of sickle design were T7 (appropriate shape and size of handle) and T9 (appropriate shape and size of blade) with score of 198 for each, followed by T1 (ergonomically designed) with score of 189. Overall six target values; 35cm length of sickle, seriated blade thickness up to 2±0.5cm, standard weight of 210gm, size of handle 11±2, size of handle 15±2 and Handle diameter of 3±0.2cm with grip space 3.5±0.2cm were decided for improving the design of sickle as per customers' requirements.

Ergonomic Evaluation of Manual Chaff Cutter Through a Varying Number of Cutting Blade and Modifying Throat Geometry

Jaya Sinha[1*], Adarsh Kumar[2]
[1]Assistant Professor, Dr. Rajendra Prasad Central Agricultural University, Pusa- Samastipur, [2]Principal Scientist, Indian Agricultural Research Institute, New Delhi, (*Corresponding Author: Jaya.sinha@rpcau.ac.in)

***Abstract*—**In India, animal husbandry is an integral part of the rural economy. India rank first in the livestock population. Animal feeding is a very important aspect of livestock husbandry and to feed these cattle, it is very necessary to have effective utilization of available feed sources. Chaff is a good feed, and easily palatable to cattle when cleanly and evenly cut, free of dust, with good colour and fresh aroma. Chaff cutter is one of the agricultural equipment, used for chopping all kinds of green and dry fodder into small pieces to feed to the animals. Due to less cost and easy to operate it is available in every households owning two or three cattle. Manually chaff cutter can be easily operated by even by female, and unskilled labour. But, operation on traditional chaff cutters owned by the farmer is physically demanding because of high rate of energy requirement and awkward work postures. Therefore, the available human-operated chaff cutter has a scope for modification based on human power and energy requirement for cutting different fodders. The ergonomic evaluation of manual chaff cutter were carried out using one, two, three and four cutting blade and modifying throat geometry. The experiments were conducted to determine the physiological parameters of human in terms of oxygen consumption, heart rate and energy expenditure during the chopping operation. The power requirement for cutting the fodder were compared with sustainable power of human and power applied by the operator by using four different blades and modified throat geometry. There was a mismatch between available human power and power requirement to cut fodder by using different number of cutting blade. Therefore the present study was undertaken to predict the power and energy requirements for cutting forage crops by varying number of blade like, one, two, three, four blade and throat geometry.
Keywords—Manual fodder cutter, Livestock, Ergonomics, India.

Physical Risk Factors among Workers of Agro Enterprises by Workplace Ergonomic Risk Assessment

Deepa Vinay, Seema Kwatra, Sunita Sharma, Kanchan Shila
G.B Pant University of Agriculture and Technology, Pantnagar

***Abstract*—**In agro enterprise the workers are exposed to risk factors such as awkward posture, repetitive motion, prolonged sitting/standing, poor work arrangement and vigorous vibration which can lead to work related musculoskeletal discomfort. The aim of this study was to assess the work risk factors faced by workers by using WERA test at the workplace. A total of 283 workers were selected from seven different types of agro enterprises from all over India for this study. The activities under which women participation was found 80% or more selected for the present investigation. The results of physical risk based on the final WERA score for each risk factor revealed that all the activities of various agro-enterprises were at medium risk level which indicates that all the tasks need to be redesigned for reducing ergonomic risk at the workplace and to reduce the chances of occurrence of work related musculoskeletal disorders.
***Keywords*—**Risk Factors, Agro Enterprises, Workplace Ergonomic Risk Assessment

Commercial Painting Hazards and Respective Personal Protective Equipment

Padmini Pandey[1], U.V Kiran[2]
[1]Research Scholar, [2]Associate Professor, Department of Human Development & Family Studies, School for Home Sciences, Babasaheb Bhimrao Ambedkar University (A central university) Lucknow (*Corresponding Author: dolly15pandey@gmail.com)

***Abstract*—**People consider paintings as hazards, but the fact is that paints consist of several different toxic chemicals that can cause significant physical harm to the painter if they would not follow an appropriate preventative measure. The mist of solvent paints may cause tremendous irritation to the skin and eyes, difficulty in breathing, and headaches as well. Exposed to vapor and fine particles induces a long-term effect in the form of chronic illness. Various kinds of PPE have been identified already, which may decrease the damaging effect of paints to some extent. Breathing masks, gloves, coveralls, boots, protective suits, goggles, hard hats, etc. are included. While further, there are still many industries where workers have to be safe by the use of PPE from contaminants throughout procedures.

Microbial Growth in Wastes and its Health Impacts on Rag-Pickers

Santoshi[1], U. V. Kiran[2]
[1]Research Scholar, [2]Associate Professor, Department of Human Development & Family Studies, School for Home Sciences, Babasaheb Bhimrao Ambedkar University (A Central University) Lucknow, Uttar Pradesh, India, tosibhu@gmail.com

***Abstract*—**Waste is any material that is of little or no value to manufacturers or consumers. With almost every activity, humans generate waste. The fast-urban development of many Indian cities has led to population growth close to dumping grounds and may exacerbate the risks. Inappropriate methods of handling and disposal of Municipal Solid Waste causes many types of pollution: air, water and soil. Indiscriminate waste dumping contaminates the supply of surface and ground water. In urban areas, municipal solid waste clogs drains, creating stagnant water for insect breeding and floods during rainy seasons. The habitat for different microorganisms is municipal waste, where their range of incidence and ability to concentrate relies on different variables, including the facility's type and location, the weather and period. The form of dropping waste site can also determine the likelihood and ability of many micro-organisms that can cause many diseases to survive. In addition to respiratory illnesses, it has been suggested that intestinal infections may be produced by associated enteric microorganisms common in dumpling soil. Rag pickers are rarely protected against direct contact and injury in developing countries, and the co-disposal of hazardous and medical waste with municipal solid waste poses a serious health threat. Also contributing to overall health problems are exhaust fumes from waste collection vehicles, dust from disposal practices and open waste burning. Serious health risks to rag pickers were identified at the dumping yard due to microbial air , soil and MSW pollution.

Exploratory Study on Occupational Health and Work Environment among Waste Management Workers in Kerala

Vinay V. Panicker[1], Francis J. Emmatty[2]
[1]Assistant Professor, Department of Mechanical Engineering, National Institute of Technology Calicut, Kerala, India
[2]Mechanical Engineering Department, National Institute of Technology Calicut, Kozhikode, India and Mechanical Engineering Department, Government Engineering College Kozhikode, Kozhikode, India (*Corresponding Author: vinay@nitc.ac.in)

***Abstract*—**In a developing country like India, where growth occurs in all sectors at exponential rates, people being employed in waste management industries will increase at an alarming rate. Waste management workers being the most downtrodden section of the society, there is a chance of exploitation of these workers. The safety and health of these workers are at risk, even in developed countries. The present study aims to undertake a face-to-face questionnaire survey for qualitatively measuring the well-being of waste collection workers in Kerala to explore the challenges and occupational hazards due to the work nature, use of tools and equipment and the work environment. The well-being of waste management workers is a function of a diverse number of factors, both physical as well as mental. A questionnaire was prepared considering the various aspects and taking standard Nordic questionnaire as a reference. A survey questionnaire was then developed for the purpose of investigating the effects of these factors in Google Forms, and the data was collected from workers by a face-to-face questionnaire survey. The geo-tagging feature was included in the questionnaire. This enabled the registering of the exact location where the survey was conducted through real-time meta-coordinate data. The responses recorded from the individual surveys have been used to reach conclusions regarding the possible causes of discomfort by examining the usage of work-related accessories. It was observed that most frequently occurring occupational problems are musculoskeletal disorders which were reported by 31% of the respondents, followed by respiratory disorders which were reported by approximately 21% of the subjects.
***Keywords*—**waste collection, occupational disorders, geo-tagging, questionnaire.

Occupational Health, Safety and Ergonomic Concerns in Small Scale Spices Grinding Mills

Arbaaz Sohail[1*], Harshita Chawda[1], Qutubuddin S.M[2]. Avinash Sambrani[1], Fateh Altaf[1]
[1 & 2] Students, 3Associate Professor, [4]Head of Department, Industrial & Production Engineering, Poojya Doddappa Appa College of Engineering, Kalaburagi, Karnataka, INDIA
(*Corresponding author sohailarbaaz1996@gmail.com)

***Abstract*—**Occupational health safety and ergonomic (OHS&E) concerns are most significant in many developing countries, because the effect of poor health, employee safety and non-ergonomic conditions exist in different workplaces in the unorganised/informal sector and are an impediment to the growth of national economy and social progress. The present work involves OHS&E study of grinding mills in the small scale sector. These units are characterised by deficiencies in workplace and/or work station design, poor work environments, excessive noise, improper working conditions, lack of safety and personnel protective gear, musculoskeletal disorder concerns, working in awkward/unnatural postures etc. the grinding mills located in North Karnataka were selected for the study. These units manufacture chilly, turmeric and other spices and supply to the hotel industry as well work as vendors to other manufacturers. The study is carried at 3 mills located around Kalaburagi and about 32 workers were involved. The study findings indicate MSD concerns among workers, issues related to air pollution and allergies due to fine dust particles and lack of safety equipment, and improper workplace design. Postural analysis indicated a majority of postures under high risk category and need ergonomic interventions. Several recommendations and suggestions are given to these units for overall improvement of safety, health and productivity. Low cost ergonomic interventions were demonstrated to improve the postures and changes in work station design are recommended. Use of PPEs is also encouraged.
Key words—Ergonomics, spices, OHS, Posture, MSD

Occupational Stress Factors Associated With Quality of Life Among Government And Non Government Bus Drivers Of Kolkata City

Samrat Dev[1], Somnth Gangopadhyay[2]
School of Design, University of Petroleum and Energy Studies, Dehradun, Uttarakhand
Department of Physiology, Occupational Ergonomics Laboratory, University of Calcutta, Kolkata, India
(*Corresponding author: sdev@ddn.upes.ac.in)

Abstract—Bus driving is considered as one of the hazardous occupations and is more likely to experience different disorders. The occupational stress along with psychological and physiological health of the bus driver play a significant factor in driving performance. The objective of this study is to assess the occupational stress factors associated with occupation and their effects among the social and professional life of bus drivers. The cross sectional study was conducted among non government and government bus drivers working at a different bus route of Kolkata city. For this study eight routes were randomly selected and 220 total male bus drivers having more than one year of experience, were enrolled in the study. The assessment of occupational stress by Occupational Stress Index (OSI) and World Health Organization's "Quality of Life Questionnaire was done. Student't' test was performed to find out whether there is any significant difference between the different parameters among the groups. From the study of the occupational stress index questionnaire it was shown that both the groups are suffering from OSI and belong to a high level. The scores of QoL were highest for the social relationship domain, followed by environmental, psychological and the physical domain, in descending order in both the groups. The results indicate that bus drivers are working in stressful environments. Due to high levels of occupational stress their quality of life (social and professional) decreases, which directly affect their relation with others, safety, comfort and overall productivity.

Keywords—Stress, Bus drivers, Social Life, productivity, Kolkata

Psychological Survey of Color Perceptions for Indian Users

Siddhant Patil[1*], Ganesh Bhutkar[2], Prakash Vaidya[3]
[1]Intern, [2]Coordinator, [3]Associate Professor Centre of Excellence in Human-Computer Interaction, and a final year B.Tech student of Industrial Engineering at Vishwakarma Institute of Technology, Pune-411037, Maharashtra, India (*Corresponding Author: siddhant.patil16@vit.edu).

***Abstract*—**This research paper presents the result of a psychological survey of colors for Indian users. The major goal of this survey is to find out the emotions evoked after observing particular colors. It also, investigates about most favorite colors of the Indian users. Color is a major factor impacting user's decision when selecting products amongst given variety of goods and services. Every user's perception and response to a certain color is different. Some users are attracted by a specific color, while others may not. This presents a challenge to the product designer while selecting a suitable color for product or its user interface, one is designing. In this survey, the user has been presented with 11 emotions associated with 11 colors as suggested by an interesting article from 99designs.com.The users were asked to select the emotion that each color evokes, based on their experience and understanding. Furthermore, the user had been asked to select his/her maximum three favorite colors out of these 11 colors. The user survey is aimed at wider range of age groups as (13-22 years), (23-59 years) and 60+ years. This survey involves both male and female users and a total of 225 valid responses were received. A deviation in the users' emotional perception has been observed for the four colors viz. Orange, Blue, Brown, and Grey. Moreover, the top three favorite colors selected by the Indian users were Black, Blue and White respectively. The results of this survey will guide the product designers as well as user interface designers in selection of appropriate colors when designing products, mobile apps or user interfaces. This survey will help product designers to influence the user's buying decisions and maximization of the product sale.

Work-Related Musculoskeletal Discomfort in Work From Home Settings during Covid-19 Lockdown and the Perceived Need of Ergonomically Designed Workstation: A Self-Reported Questionnaire-Based Survey

Dr.Bharati Jajoo[1], Dr. Shweta Bhatbolan[2]
[1]Chief Body Dynamics, Bangalore, India, [2]Assistant Professor, SDM College of Physiotherapy, SDM University, Sattur Dharwad, Karnataka bharati@bodydynamics.in

Abstract—Objective: The Covid-19 pandemic has created a compulsory work from home (WFH) situation for many and working on non-ergonomically designed work stations in work from home (WFH), work setting may put computer/laptop users at an increased risk of developing work-related musculoskeletal discomfort. This study is done to identify the prevalence of work-related pain and discomfort among work from home (WFH) computer/laptop users, and to identify the perceived need for ergonomic help among the WFH computer/ Laptop users. This may guide ergonomic design and modifications in work from home (WFH) settings and to design preventive strategies to prolong work duration with well-being and job satisfaction.

A 31 questions online survey questionnaire was designed to evaluate work-related musculoskeletal discomfort among individual forced to work from home (WFH) due to Covid-19 lockdown

A total of 400 people were contacted and we received a total of 244 responses forming a 61% response rate. There mean age of participants was 37±7 years with 22% women and 78% were men. The prevalence of work-related musculoskeletal discomfort was found to be 83%. The most commonly reported area of discomfort was low back pain reported by 50%. While the other areas like Neck, Leg, Shoulder, and Upper Back were 47%, 36 %, 33%, and 20% respectively. 84% of the total respondents felt that there is a need to have an ergonomically designed workstation for WFH settings.

WFH can affect many aspects of a person's life and wrong posture adapted due to improperly designed workstation has the potential to limit their work efficiency and job satisfaction. Development of musculoskeletal discomfort due to incorrectly designed, makeshift arrangement work stations are harmful and may curtail the productive working hours and may lead to health issues. We found a very high prevalence of work-related pain and discomfort in the WFH computer and laptop users in our study. Therefore more emphasis is needed on the education of WFH ergonomics as well as the ergonomic modifications are the need of the hour for WFH settings as WFH is the safest option under the current Covid-19 situation.

Computational Assessment of Indian Excavation Workers' Posture and Biomechanical Analysis Using CATIA

Manoj T. Gajbhiye[1], Debamalya Banerjee[2], Saurav Nandi[3]
[1]Research Scholar, [2]Professor, Department of Production Engineering, [3]Assistant Professor, Department of Mechanical Engineering Jadavpur University, Kolkata (W.B.) India. (*Corresponding Author:manoj211178gajbhiye@gmail.com)

***Abstract*—**Excavation is the process of removing/extracting soil from the ground to lay down the foundation and erection of column for construction work. This work is hazardous as well as dynamic in nature which requires high physical effort, carried out manually by men and women in India. These workers are exposed to different physical and environmental effect eventually exposed to work-related musculoskeletal disorders (WRMSD). The assessment of such type of dynamic work is not possible without using the computer. This study carried out on the workers engaged in excavation work for construction. Two postures identified for analysis from observation, photos and videos recording during the survey. Most hazardous postures considered for evaluation and digital human models designed and simulated in CATIA V5 software. The RULA and Biomechanical analysis of the forces performed on the Digital Human Model (DHM) as well as on real images also. The RULA score of the two assesses postures shows that investigation and changes required immediately. The Biomechanical Analysis of forces shows that compression force crosses the NIOSH recommended limit in posture 1, while joint shear loads in posture-2. RULA and Biomechanical Analysis show that both working postures are not suitable for excavation work as in both positions; body and spine are under high risk. The recommended conceptual body posture can help to minimize the WRMSD problem.

Keywords—Work-related Musculoskeletal Disorders (WRMSD); Ergonomics; Excavation; RULA; Biomechanical; CATIA

Analysis of Musculoskeletal Disorders (MSD) Risk Factors among Washing Machine Users in South Region of India

P. Shrisowmya[1], T. Aravind Krishna[2], S. Monisha Gowri[3], K. Adalarasu[4,*]

[1]HR Manager, Caraway Pharma PvtLtd, Bangalore[2] , Director, Centre for Business Research in Data Logic and Analysis, Coimbatore, [3]PG Student, Department of Electronics and Communication Engineering, College of Engineering, Anna University, Guindy, Chennai, [4]Department of EIE, SEEE, SASTRA Deemed to be University, Thanjavur, Tamil Nadu (**Corresponding author*: adalarasu@eie.sastra.edu)

***Abstract*—** In the recent few decades, use of washing machines for effortless washing instead of washing with hands has become quite common among many households. It's a blessing for the working population, elderly, and maids as it considerably reduces the physical strain and time associated with manual washing. Though washing machine designs have evolved over years towards reducing physical effort, there are still a few basic tasks such as loading and unloading clothes, operating controls, and panels which are strenuous during operation and prone to health issues in the long run. Ergonomic study and recommendations help to address such issues and ensuring the well-being and safety of the users. In this study, we investigate the ergonomic issues associated with washing machine users in South India. An Ergonomics survey with the aid of a self-assessment questionnaire was conducted among 83 subjects (59 females and 24 males) with age in the range of 18 – 56 years. Display design, panel design, and top, front load design was investigated for Musculoskeletal Disorders (MSD) using the RBG (Rehabilitation Bioengineering Group) pain score. Pain score was analyzed in body, neck and shoulder, upper arm, low back, and knees regions, and a statistical test was performed using unpaired t-test and ANOVA (Analysis of Variance) to find the significant differences between the pain score concerning the different factors (Male vs. Female, Panel Design, etc.). The statistical result shows that subjects who use top-loading washing machine have significantly ($p<0.05$) high pain in the upper arm compared to those using front-loading washing machines. Similarly, males have significant ($p<0.05$) pain in knee region compared to females. Among the different panel designs, knob design has significant ($p<0.05$) pain in the body, neck and shoulder region as compared to jumping lights and panel with full buttons. Among the different button designs, the rubber type of button design has significantly ($p<0.05$) less pain compared to plastic and touch screen designs. From the findings of the study, it is recommended that front-loading with rubber button design is an appropriate ergonomics design for washing machines**.**

***Keywords*—**Musculoskeletal Disorders (MSD), Washing Machine, Ergonomics, RBG (Rehabilitation Bioengineering Group) Pain Score.

Designing of Apparel for Arm Fractured Women

Dr. Irfana Qiyamuddin Siddiqui[1*], Dr. Sunita Kale[1]

Department of Textiles & Apparel Designing, College of Community Science, VNMKVParbhani, (MS),India

*(Corresponding Author: siddiquiirfana7@gmail.com)

***Abstract* —** A survey was conducted among 75 arm fractured women from various orthopedic hospitals & civil hospital of Parbhani district of Marathwada region of Maharashtra. Information about problems faced by the women with arm fractured and plastered in putting on and taking off their clothes and so also the problems perceived by their care takers were collected. A total 30 arm fractured women were selected as the subjects of the study. Two designs of Punjabi Kameez suitable for the women with arm disability were developed and wear trials were conducted to assess their suitability. Kameez designed with special features like full length front opening with suitable fasteners, set in sleeve with large arm- hole, full length sleeves with side sleeve opening using press buttons as fasteners, Gent's roll collar and big sized flap pocket at waistline was reported to be highly acceptable, suitable and comfortable for the arm fractured women.

***Keywords* -** Arm fractured women, plastered arm, Punjabi Kameez, wear trials

Relationship of Pain in the Lower Back and Knee with Gender, Age and BMI of the Pharmaceutical Supply Chain Workers

Pallavi Murarka[1], Dr. Manjit Kaur Chauhan[2]
[1]PhD Scholar with Department of Resource Management, SNDT Women's University, Mumbai,
[2]Associate Professor with Department of Resource Management, SNDT Women's University, Mumbai, Maharashtra, India.

Abstract—Workers adopt various awkward postures to perform their jobs at the workplace, which may lead to work-related musculoskeletal disorders. The Workers in supply chain units of pharmaceutical companies do activities such as standing, walking, kneeling on the floor, bending, and sitting in a squatting position. These workers reported musculoskeletal discomfort (MSD) in the lower back (62.7%) and knee (32%). This study aimed to analyse the potential causes of MSD in pharmaceutical supply chain workers and examined if age, BMI, or gender of workers can contribute to pain in the lower back and knee. 116 workers: 91 males and 25 females, from 11 supply chain units were interviewed, and their anthropometric measurements were taken. Non-parametric tests were used to see the dependence of pain on BMI and age, and the Chi-square test was used to see the dependence of pain on gender. Rest results showed that lower back pain is not dependent on age group, BMI level, and gender of workers. However, pain in the knee was found to be dependent on gender but not on age group and BMI level. Therefore, postures of supply chain workers at the workplace need to be assessed as a potential cause of the MSD in the lower back, and a workplace design intervention is required to improve the work posture.
Keywords—Age groups, BMI, Gender, Musculoskeletal disorders, Posture, Work-related musculoskeletal disorders.

Analysis of Biomechanical Risk Exposures in Bank Office Workers

Dr. Tejashree A Dabholkar[1], Rasika Hatti[2], Dr. Ajit Dabholkar[3]
[1]Associate Professor, [2]Masters Student, [3]Professor and Head of Department, Sports Physiotherapy Dept School of Physiotherapy, D.Y. Patil University, Navi Mumbai (*Corresponding Author: tejashreedabholkar81@gmail.com)

***Abstract*—**Banking often involves long working hours and is a largely sedentary profession. Work related musculoskeletal disorders (WRMSDs) lead to pain and disabilities in this profession. This study aims to identify risk factors among bank workers. In this study 200 bank workers performing only desk jobs in various banks of Mumbai and Navi Mumbai with job experience of minimum one year were analyzed for biomechanical risk exposure using Rapid Office Strain Assessment (ROSA). Neck and back pain was most prevalent areas affected in bank office workers with medium to high biomechanical risk for WRMSDs.
Keywords—Bank office workers, work related musculoskeletal disorders, ROSA analysis.

Analysis of Ergonomic Issues Faced by Students & Teachers in Online Education

K. Nirmal[1], K. Adalarasu[2*], T. Aravind Krishna[3]

[1]Student, Department of Computer Science and Engineering, AMRITA University, Coimbatore, Tamil Nadu

[2] SASTRA Deemed to University, Thanjavur, Tamil Nadu in the Department of EIE, SEEE. [3]Centre for Business Research in Data Logic and Analysis, Coimbatore, Tamil Nadu (*Corresponding author: adalarasu@eie.sastra.edu)

Abstract– With the global pandemic of COVID-19, many educational institutions including Schools and Colleges are forced to Online Education for imparting teaching. Students and teachers have been forced to use computer-based tools such as Desktop PC/ Laptop/ Smart Phone and other accessories for delivering lectures, submitting assignments, and for evaluation purposes. In this context studying ergonomic issues among teachers and students due to this 'sudden' change in the educational process (as compared to 'predominantly' Chalk and Talk methods with both teacher and the taught being physically present in the same location) becomes important and necessary for improving the quality of education in a broad sense. This study surveys the human factors/ergonomics (HF/E) issues among 75 subjects (45 females and 30 males) with age in the range of 18 – 40 years' college students' teachers in south India using the Self-Assessment Questionnaire and 36 Health Survey (SF-36) Questionnaire. On comparing the students based on devices used for online learning, laptop users had significantly ($p<0.05$) higher pain in the legs when compared to desktop and mobile phone users. This may be due to laptop users attending classes with laptops on their laps or not using proper ergonomics postures during online learning which leads to high pain in the legs. Mobile phone users had the least pain. When comparing gender, females have significantly ($p<0.05$) higher pain in the neck and shoulder region compared to males. This may be due to female students resorting to a particular posture for long durations in their pursuit to concentrate hard. On comparing the effect of durations for online learning, college students engaging in online classes for more than 24 hours per week, have significantly ($p<0.05$) higher pain in most of the body regions viz. neck, shoulder, upper arms, lower arms, buttocks, palm, thighs, and legs. The Ministry of Human Resources Development (MHRD), Government of India, has provided a guideline that the duration of online classes should not be greater than 3 hours per day for students undergoing higher classes (Class 8 to Class 12). Here we are considering college students so; we have considered 4 hours per day, i.e., total of 24 hours per week. Our result corroborates MHRD guidelines by showing that students engaging in online classes for more than 24 hours per week are prone to severe pain and related Musculoskeletal Disorders (MSDs). The study reveals that there are ergonomic issues associated with online education and students/ teachers need to consider these aspects and plan for proper interventions such as proper setup, devices and breaks to maintain health and safety.

Keywords– Online Education, Ergonomics, Self-Assessment Questionnaire, 36 Health Survey (SF-36) Questionnaire

Cognitive Psychology and Student-Centred Pedagogy for Students Creativity: An Analytical Study

M. S. Balasubramani[1*], Dr. Najmuddin Aamer[2], Shrikrishna R. Sonawane[1]

[1]Assistant Professor, Dept. of Humanities in Theem College of Engineering, Boisar, Maharashtra State, India. [2]Professor, Dept. of Computer in Theem College of Engineering, Boisar, Maharashtra State, India. (*Corresponding Author: balaji_44@ymail.com).

Abstract—The paper emphasizes the importance of cognitive psychology and student-centred pedagogy for creativity with a brief review of literature that defines the common distortion, thinking errors, effect of students' attitudes towards learning in classrooms and it presents general background and description of facts and cognitive perspectives. The study portraits the possible cognitive distortions in learning held by Indian university students. It also analyzes the possible ways that can replace the learner's negativity into more positive attitudes and self-defeating attitudes into learning the language of love, the decorum of respect and a culture unity to experience the learning of collaborative, experiential, and problem-based to strengthen their capacity for creativity with resilience at student-centred learning.

Keywords **-** cognitive psychology, student-centred pedagogy, positive attitudes, collaborative learning, experiential learning, problem-based, creativity, resilience.

Resurgence Improvement using Ergonomics Practice in Hotel Industry

M. Nayas
IQAC Coordinator, Assistant Professor, Department of Management Studies, Annai Fathima College of Arts and Science, Thirumangalam, Tamilnadu, India. *(Corresponding Author: nayasn@yahoo.co.in)

***Abstract*—**Ergonomics means nomics of laws bonded with a work balance. Hospitality industry is a service sector which employee major percentage of human work force in Hotel, Restaurant, Motel, Recreational resorts and centre. The human capital is major assert of the Hotel industry which need hospitality service to guest. The hospitality in house and aid facility enhancements that focus on ensuring smooth flow of operation without taking into consideration the needs of workers are deemed useless whenever operational inefficiencies occur due to worker's health and safety. Therefore, the integration of safety precaution for COVID 19 and the ergonomics ensure both improvement on efficiency and productivity of the operation and the workers. This paper proposes a practice module that takes into account process variables department like front office, Housekeeping and service, ergonomic variables such as body posture and awkward position, weight handled or muscular load in service and using some equipment. To verify the effectiveness of the integrated module, the proponent incorporated an actual industrial case to compare and evaluate existing and proposed ergo practices results and also vestibule training procedures and support methodology applicability. The hospitality professionals need high time to handle guest with pre medical practice and ergo practice**.**

Keywords — Ergo practice, hotel industry, hospitality professionals, occupational health

Workplace Heat Stress and its Effect on Worker's Health Employed in Glass Manufacturing Unit

Sonia Tewari[1], Deepa Vinay[2]
[1]Research Scholar, Department of Family Resource Management, College of Home Science, G.B. Pant University of Agriculture And Technology, Pantnagar, Uttrakhand, India.(*Corresponding Author: soniatewari38334@gmail.Com)
[2]Professor Department of Family Resource Management, College of Home Science, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttrakhand, India

Abstract — The study was planned to assess the workplace heat stress and its effect on worker's health engaged in a glass manufacturing unit of UP, India with a total sample size of 120 workers selected purposively without replacement. Subjective symptoms of heat stress among 120 workers were assessed using a checklist whereas heat stress of the 30 blowers from the total and workplace heat stress were assessed through OSHA'S Heat hazard assessment method and heat stress monitor (QUESTempº 36) respectively. The findings revealed that almost all the workers were affected by the heat stress as they reported symptoms like rising in body temperature (96.66%), heavy sweating (94.16%), skin hot and dry red face (87.50%), weakness and fatigue (80.83%), headache (61.67%) and dehydration (57.50%). The workplace heat stress analysis showed that WBGT-IN (32.29+1.42°C) was above the TLV (29°C) as recommended by ACGIH. The metabolic rate of workers lies in between (184.29 W to 390 W). The finding of the research study suggests that the subjective symptoms of the heat stress reported by workers confirmed the fact that the workers were prone to heat illness as they are exposed to heat hazards conditions and working above the TLV of 29°C.

Design and Development of a Seat Simulator to Study the Body Mass Supported on Seat Pan and Backrest

S. Thokchom[1]*, B. K.N. Dewangan[1], and C. A. Pal[1]
[1]Department of Agricultural Engineering, North Eastern Regional Institute of Science and Technology, Nirjuli, Arunachal Pradesh, India. (*Corresponding author: sarjuthokchomae17@gmail.com)

***Abstract*—**Improper design of the seat and prolong sitting causes back pain. Body mass supported on the seat pan and backrest is used to design seat suspension as well as in selecting seat cushion. Therefore, a seat simulator was designed and developed to measure the body mass supported on the seat pan and the backrest for four different seat pan slopes (5°, 10°, 15°, and 20°) and five different backrests reclines (100°, 105°, 110°, 115°, and 120°). A set of 4 load cells were mounted on the seat pan while another four load cells were mounted on the backrest. The design simulator was tested with six subjects to verify the designed simulator. The results showed the body mass supported on the simulator is comparable to the body mass of the subjects at different seat pan and backrest combinations. The seat simulator can be used to study the body mass supported on different seat configuration.
Keywords— Design, seat simulator, body mass supported on the seat pan and backrest.

Impact of Covid-19 Pandemic on Occupational Stress Level among IT-Professionals

Dr. Stuti Gupta
Banastahli Vidyapith, Rajasthan, India, *(Corresponding Author: stuti.guptalko@gmail.com)

Abstract—Occupational stress among IT professionals has always been a key concern for the industry. The Covid-19 pandemic has affected the IT organizations in all three dimensions i.e. complexity, uncertainty and opportunities. Career uncertainty, fear of losing job, work life imbalance, improper time management, inadequate working conditions, lack of communication and forceful adaptation to new requirements and tasks have emerged as key challenges for IT professionals due to workplace transformation caused by pandemic situation. Study was conducted to identify the impact of Covid-19 pandemic situation among the IT professionals due to workplace transformation and other constraints resulted due to these changes. The Occupational Stress Inventory (OSI) was used to assess the impact of Covid-19 pandemic among IT professionals. A sample of 100 IT professionals (50 male and 50 female) was taken for the study and response(s) were compiled. Findings revealed that Occupational Stress among IT professionals have significantly increased due to the drastic change caused by pandemic in the personal and professional life of employees. It was also observed that psychological stressors were more prevalent than environmental and physiological parameters. Female employees were identified to be having higher stress level than their male counterparts. The study suggests that work from home should not be considered as a replacement for traditional work culture. Although it may increase the productivity and save cost but it may adversely affect the social life and wellbeing of employees in long term.
Keywords **-** Occupational Stress, COVID-19, pandemic, mental health, anxiety, psychological impact, depression, Information Technology, IT professionals.

Is the COVID-19 Lockdown Stressful for College Students?

B. Visweshwaran[1], J. Kiron[1], Mahesh Jayaraman[1], K. Adalarasu[2], M. Jagannath[1]*
[1]School of Electronics Engineering, Vellore Institute of Technology, Chennai, India, [2]School of Electrical and Electronics Engineering, SASTRA Deemed to be University, Thanjavur, India. *(Corresponding Author: jagan.faith@gmail.com)*

***Abstract*—**The global pandemic of COVID-19 is a challenging period for students all over the world. With extended periods of lockdown, students are forced to sit in front of electronic gadgets to undergo online education. There are uncertainties regarding their academic grades, they might have lost an opportunity for a great internship or some students might just not be comfortable with online education. The objective of this study was to focus on how stressful the COVID-19 lockdown for college students. The study was conducted among 107 college students (59 males and 48 females) with the help of an online survey consisting of a 25-item self-administered questionnaire. The mean age of the students was 20 years with a standard deviation of 2.4 years. The results showed that during this lockdown, the outstation students are significantly ($p<0.05$) spending time for house chores and are finding it difficult to cope with the academics than the hometown students. The outstation students are significantly ($p<0.05$) worried about their financial situations than hometown students. The female students are significantly ($p<0.05$) worried about college closure than male students. The female students are significantly ($p<0.05$) distracted with household chores during online classes compared to male students. The findings concluded that the outstation students do a lot of household chores in addition to online classes, and also concerned about their financial crisis because many of them are still at hostels or as paying guests. The worry of education halting is a lot more in female students since they might not be able to continue their education. The female students are more distracted from their online education during the lockdown. The reasons may be that they spend their time not only for online learning but also a significant amount of their time is being spent to assist their family with day to day activities.

Keywords: COVID-19, College students, Learning outcomes, Online Education, Stress.

Understanding the Emotional Effects of Line, Shapes, Form and Colour in the Prints Created by Two Indian Printmakers on the General Public

Namrita Sharma[1*], Utpal Barua[2]
[1]Indian Institute of Technology Guwahati, Assam, India. (*Corresponding Author: namri176105004@iitg.ac.in).
[2]Professor, Department of Design, Indian Institute of Technology, Guwahati, Assam, India.

***Abstract*—**Conventional Printmaking for artists has been a process of planning as well as a surprise in terms of the outcomes of the utilisation of materials, methods and visual effects. Conventional printmaking methods consist of Collagraphy (Impression from layers on a cardboard surface), etching (taking imprint from incised marks on the surface of a metal plate), lithography (taking an impression from the surface of the stone), and silkscreen (stencil or a cutout print). As compared to painting or sculpture, Printmaking as a medium of visual expression got recognised in the Indian art scenario quite late due to its ability to produce multiple copies of the same design/visual. In the Indian art scenario, few artists were involved in experimenting with this kind of medium. Apart from Gagendranath Tagore, Nandlal Bose and others, two influential artists who contributed to the enrichment of visual language in Indian and international printmaking scenario are- Somnath Hore and Krishna Reddy. Both the artists experimented immensely with the techniques, materials and process to evolve their pictorial vocabulary in order to translate their emotions on a tangible surface. Since these two visual artists kept on innovating the graphic elements- use of lines, shapes, forms and colours, it will be interesting to know and understand the emotional impact and record the response of the general public which may further be utilised in designing museum/ gallery spaces or designing visuals for mass communication on particular issues. This paper shall study and analyse the emotional responses of the lines, shapes, forms, colour and texture created by two Indian artists- Somnath Hore and Krishna Reddy in their prints on a given population.

Ergonomic Evaluation of Family Relations in India Impacted by COVID-19 Lockdown

J. Kiron[1], Mahesh Jayaraman[1], B. Visweshwaran[1], M. Jagannath[1]*
School of Electronics Engineering, Vellore Institute of Technology, Chennai, India, *(*Corresponding Author: jagan.faith@gmail.com)*

***Abstract*—**In India, the number of COVID-19 cases has been increasing exponentially since January 2020. While the main focus during this pandemic has been to find a cure and stop the transmission of the disease, a lot of people are going through unspoken problems in their family. This pandemic has brought an imbalance to the well-being of families and children. This might be due to various reasons such as lockdown related stress, financial instability, or the burden of caregiving among parents. To evaluate these impacts on family relations due to the COVID-19 lockdown, an online survey was conducted among 132 Indian participants (73 males and 59 females) with an age range of 17 – 71 years. The 40-item questionnaire was administered from several validated questionnaires such as Level of Expressed Emotions, Camberwell Family Interview, the Family Attitude Scale (FAS), Parental Bonding Instrument (PBI), and the Family Environment Scale (FES). The results of the study revealed the following: the females in the family are significantly ($p<0.05$) more concerned that their family might get infected by COVID-19. The female spouse shows significantly ($p<0.05$) a warm and comfortable relationship with their male spouse during the lockdown. The married participants enjoy significantly ($p<0.05$) spending time with their family during the lockdown compared to the unmarried participants. The experience of anger is significantly ($p<0.05$) high among unmarried participants than married participants. The participants belonging to the nuclear family are significantly ($p<0.05$) prone to be angry with their family members than participants belonging to the joint family. The study concluded that the female members of a family are more concerned about their family's well-being and relations than males. The married people tend to be in harmony with their family members more than the unmarried people during the COVID-19 lockdown. Since the nuclear family contains fewer people and the feeling of containment is more, members of a nuclear family tend to be angrier on their family members more than joint family members.
Keywords—COVID-19, Lockdown, Family relations, Stress, Well-being.

Ergonomic Evaluation of Community Kitchen For Midday Meal Scheme-A Case Study

Pooja Aloorkar[1], Qutubuddin S.M[2], Pooja Rangdal[3], Saikiran Patil[4], Devsudhakar Patil[5]
[1, 3&4] Students, [3,5]Associate Professor, Industrial & Production Engineering, P.D.A.College of Engineering, Kalaburagi, Karnataka, India, *(*Corresponding Author:* poojaaloorkar01174@gmail.com)

***Abstract*—**Ergonomics refers to the study of the kind of work people do, the environment they work in and the tools they use to perform the work. Community kitchens are the places catering to the needs of the society by offering mid-day meals to the school children in rural areas. The work in a typical kitchen is difficult from an ergonomics perspective and many ergonomic deficiencies can be found which needs to be addressed. The work involves cooking in large pots, cleaning, washing, manual handling, loading and unloading, packaging and transportation of food to various schools. The work environment is challenging, working in awkward postures leading to development of musculoskeletal disorders. The present study focus on a community kitchen in Kalaburagi district offering mid-day meals to about 15000 children every day. The kitchen was studied from an ergonomics view to find out the deficiencies and associated problems and to suggest improvements. The layout issue was also addressed. Postural analysis using RULA and REBA showed a majority of working postures in high risk category. Occupational safety and health issues are also a major area of study focussing on the use of safety and personal protective gear and reducing the number of accidents. The findings of the study are highlighted in the paper and suitable suggestions and recommendations are made to overcome the ergonomic and OHS issues.
Keywords—Community kitchen, Ergonomics, MSD, RULA, REBA

Working Posture Analysis of Female Residential Building Sweepers using OWAS Method

Hemani Malhotra[1], Manjit K Chauhan[2]
[1]Sir Vithaldas Thackersey College of Home Science (Autonomous), SNDT Women's University, Mumbai.
[2]Department of Resource Management, SNDT Women's University, Juhu, Mumbai. *(*Corresponding Author:*hemani.malhotra@svt.edu.in)

Abstract —Previous studies on various occupations requiring manual material handling have shown an association between WMSDs and heavy load lifting, repetition, forceful exertion and awkward posture; also, their effect on health and quality of life. The objective of the study was to investigate the postures and related musculoskeletal problems experienced by female residential building sweepers working in urban Mumbai. A cross-sectional study was conducted on 200 sweepers for MSD problems and posture analysis on 120 residential building sweepers with mean age 38.4 years. A standardized Nordic questionnaire was used to assess the MSD problems. For the posture analysis Ovako Working Posture Analysis System (OWAS) was adapted. Data was analysed using descriptive statistics. The results of the study revealed that 85.5% of the sweepers reported low back problems, 83% shoulder and 52% reported calf pain. Majority of the sweepers adopted 5 main postures 1. Collecting garbage and putting it into a bin, 2. Sweeping passage area 3. Sweeping staircase, 4. Sweeping parking area 5. Pulling garbage bin and 6. Carrying bin on shoulder to dispose. Most of these activities were performed in standing forward bending position with arms abducted and knee bent. The activity of putting the garbage in the main society bin was classified into OWAS category 4, and sweeping the passage/ parking and pulling the garbage bin to the main gate into category 3. Maximum working time was spent on taking the garbage from individual homes followed by sweeping/mopping the floor or staircase or wing entrance. Comparatively less time was spent in segregation of waste or carrying garbage to the main gate. In the present study, the repetitive nature of tasks and awkward posture resulted in high incidence of MSD problems. It is suggested that to have ergonomic intervention by conducting training programs on posture, safety measures and periodic medical check-up for the sweepers.

Experimental Study on the Effect of Container and Worker Characteristics on a Lifting Task

Saman Ahmad[1*], Atif Saleem[2]
[1]Department of Mechanical Engineering, A.M.U, Aligarh, India (*Corrosponding author: saman.ahmad@yahoo.co.in; sahmad.me@amu.ac.in),[2]M. Tech. Student in the Department of Mechanical Engineering, A.M.U, Aligarh, India.

***Abstract*—** Lifting at work is considered an important risk factor for low back pain (LBP). It results in considerable human suffering and economic burden on the industry. The present study attempts to throw light on a few lifting parameters and their effect on a manual lifting task. Experimental investigations were carried out to examine the effect of container and worker characteristics on maximum acceptable load limit (MAWL), oxygen uptake and compressive forces developed in the L5/S1 joint during the task. A psychophysical approach was used. ANOVA was carried out on the data collected. The results indicated that box dimensions, handle position, age and experience had a statistically significant effect on MAWL. Further, it was found that despite higher MAWL, experienced subjects showed a lower oxygen uptake as compared to novice ones across all age groups. The L5/S1 compressive force was, however, higher for experienced subjects.

Effect of Lifting Height and Weight Magnitude on Biomechanical Loading during Manual Lifting

Anurag Vijaywargiya[1*], Mahesh Bhiwapurkar[1], and A. Thirugnanam[2]
[1]Department of Mechanical Engineering, SOE, OP Jindal University, Raigarh, [2]Biotechnology & Medical Engineering Department, National Institute of Technology, Rourkela, India (*Corresponding author: anurag@opju.ac.in)

***Abstract*—**In India, manual material handling (MMH) activities in asymmetrical postures are very common in the manufacturing industry and building construction sites. MMH involves any tasks that require a person to lift, lower, push, push, hold or carry objects, vertically or horizontally, from one location to another with hands. These physical manual activities overtax the human musculoskeletal system, which may exceed workers' physical limitations. The measurement of ground reaction forces (GRFs) shows a good measure of the musculoskeletal stresses being exerted on the workers performing such tasks. The research studies on the effect of vertical GRF and loading rate (LR) on the human body during running, walking, and jumping were well documented, but rarely have been used to evaluate lifting tasks. There is thus a need for a scientific study to investigate the effect of lifting task parameters and their interactions on the GRF and LR of workers in dynamic lifting human activities. This experimental study investigated the effect of lifting task parameters; lifting magnitude and lifting height based on subjective and biomechanical loading estimates. The subjective estimate was obtained using workload assessment by body discomfort chart. The biomechanical loading (loading rate) was calculated from GRF data, obtained using a force plate. Twelve male subjects in the age group of 20 to 25 years lifted container of 5 different weights between 10 to 20 kg, from below knee height (origin) to various destination heights (below knee, knee, waist, shoulder, and ear level), In the experiment, the subjects were instructed to lift the weight in a 90-degrees asymmetric posture using free-style lifting techniques. Both the task parameters; lifting weight, and lifting heights were observed to be significant. The results showed that vertical reaction forces increase when subjects lift the weight from the floor to Ear height. It was also observed that the instantaneous loading rate increases with increase in level of lifting magnitude and lifting height; a significant extra loading rate is required to change the lower level of load and destination height to higher levels. Safe limits for significant factors are proposed to result in the optimal performance of the manual lifting task

Adjustable design intervention for Rail Sahayakas to reduce physical discomfort

Isha Deosthali[1*], Nishant Bagmar[2], Wricha Mishra[3]
[1,2] B.Des User Expereince Design, MIT Institute of Design, MIT ADT University
[3] Faculty, User Expereince Design, MIT Institute of Design, MIT ADT University, Pune, MH-412201, India, (*Corresponding Author: ishad2000@gmail.com)

Abstract—"Coolie's" are recognized as one of the oldest occupations under the unorganized sector in India. More than 90% of the workers who contribute to the economy of the country are under the unorganized sector, making it essential to look into their work conditions and to increase their efficiency of work. In recent years, the world prefers mechanization at work places, but in the Indian railways the sahayaks are directly exposed to strenuous physical activity which they endure for their livelihood. In view of the above, the current study focuses on the ergonomic risks the workers experience and proposes a possible intervention for increasing the efficiency and reducing the musculoskeletal problems they face. For the purpose of the study several methods like self - reported questionnaire, REBA, NMQ, WERA, QEC were used to assess and analyze the ergonomic risks and the symptoms of the MSD among the sahayaks. The results of the study contribute in planning and implementing an ergonomic design intervention. Based on the results of the study, we propose a design intervention of adjustable trolley which could be altered according to the sahayak's convenience and can be rolled over a ramp on the staircases making it an effortless and efficient design to reduce the physical strain experienced by the sahayaks.

Keywords—Rail Sahayaks, Rapid Entire Body Assessment (REBA), Nordic Muscoskeletal Disorder (NMQ), Postural Discomfort, work station redesign

Use of AI Technology for Children With Special Needs: A Review

Namrata Arora Charpe[1] and Swati Bawa Sawhney[2]
[1]Associate Professor, Banasthali University and [2]Research Scholar, Banasthali University

***Abstract*—**The main objective of this article is to understand the usefulness of artificial intelligence in the area of special education and suggest recommendations for the same. In the presented literature review, different types of special needs were explored to identify the positive impact of artificial intelligence to assist the educational needs of disable children. In various research studies carried out on children, it has been observed that Artificial intelligence plays a significant role in identification as well as providing intervention for children with disability. The current research paper reviews and tries to capture the best practices / models (Indian and International) carried out using artificial intelligence especially for the children with special needs.

Ergonomics in DIY Learning: Comparative Study of Children's STEM Education Kits Assembling Experience

Gurmeet Singh[1*], Sanjay Gupta[2]
[1,2] World University of Design (WUD), Sonepat, Haryana, India,.(*Corresponding author: gurmeet4design@gmail.com)

***Abstract*—** Children love 'Do It Yourself' (DIY) learning kits but face difficulties in assembling them due to ignorance in designing and manufacturing of those kits and parts. As a result, they feel fatigued, get injuries and develop disinterest in the learning process. This study investigated two science, technology, engineering and mathematics (STEM) kits with 10-12 years old 68 children studying in classes 6th and 7th in Delhi-NCR to map their kit assembling experiences in context with physical ergonomics and to analyze the correlation between their experiences, ergonomic considerations in the design of kits and students' assembly time, injuries, engagement and overall mood while assembling the kit.

Students who completed kit assembly successfully reported to explore the subject more and showed interest to assemble more STEM education kits as compared to those who couldn't complete the kit assembly or took more time to do so. Thus, ergonomic considerations may help to boost the sales of such kits and the findings of this study may help designers to design playful assembly experiences for students.

***Keywords*—** Hands-on Learning, User Experience, Product Usability, Ergonomics for Children, Ergonomics in Education.

Determining Static Muscle Strength Among Glass Artware Manufacturing Workers

Bhawana Rathor
Research Scholar, Centre of Excellence in Ergonomics and Human Factor Engineering, NITIE Mumbai

Abstract— Diminishing of static muscular strength is the most common occupational health issue among handicraft workers engaged in hand-intensive jobs. A cross-sectional comparative assessment was performed to assess the muscular strength among the glass artware manufacturing workers engaged in five different activities, i.e. mixing, loam making, loam carrying, spiral machining and cutting: 120 male workers were selected, and digital grip dynamometers were used to measure their maximum handgrip and pinch strength. Results: The static muscular strength varies significantly among the different activities of glass artware manufacturing. The difference in grip strength in the right and left hand unravel that the exposure to hand tools for a prolonged period plays a vital role in muscle strength. These findings indicate that static muscular strength varies significantly due to repetitive use of hand tools. The observed values of muscle strength in the dominant hand were significantly lower in spiral machining while cutting workers had the highest strength. Conclusion: The decrement in pinch grip strength was evident due to long cycle repetitive pinching movements of distal phalanx during hand knotting and spiral making. This study proposes the need for ergonomically designed hand tool interventions that may reduce the accumulation of diminishing in static muscle strength.

Keywords— Static muscle strength, handgrip, pinch grip, carpal tunnel syndrome, ergonomics, Glass artware

Ergonomics In Household Accidents

Dr. Reema Chaurasia[1], Prof (Dr.) Maneesha Shukul
[1]Institute of Home Economics University of Delhi, New Delhi, [2]Department of Family and Community Resource Management, Faculty of Family and Community Sciences, The M.S. University of Baroda,Vadodara-390002. (*Corresponding author: reemach@gmail.com)

Abstract— 'Ergonomics' unfolds the relationship of the work, worker and workplace. The knowledge of the field helps one to avoid injuries, accidents and undesirable occurrences. When the relationship among the three components gets disturbed, this results in undesirable events. These undesirable events have personal, social and economic implications and that too when they occur at the place which is considered to be the unscathed. Extensive review of literature stressed upon the need to conduct a study on the assessment of the knowledge and practices of homemakers regarding arrangement, storage and placement of household items in the different areas of the house to avoid accidents. Therefore, a study was conducted with the objectives of studying the causes of household accidents with respect to ergonomic aspects and to study the level of knowledge and practices followed by homemakers to avoid household accidents in selected areas. It was carried out in five urban slums of Delhi on a sum total of 90 respondents who were selected through snowball sampling technique and were interviewed to assess the same. The results of the study showed that falls were the most caused accidents. One of the major cause was falling from the stool or chair. Burns as well as wounds, cuts & scratches accounted for the second highest number of accidents. Knowledge and safety practices of the homemaker were found to be average in the selected areas of the house. Coefficient of correlation was computed to test the hypothesis. It was found that there was no relationship between knowledge and safety practices of the respondents.

An Ergonomics Perspective of Female Homemakers in India during COVID-19 Lockdown

Mahesh Jayaraman[1], B. Visweshwaran[1], J. Kiron[1], N. Nathiya[2], M. Jagannath[1]*
[1]School of Electronics Engineering, Vellore Institute of Technology, Chennai, India, [2]School of Advanced Sciences, Vellore Institute of Technology, Chennai, India. *(Corresponding Author: jagan.faith@gmail.com)*

***Abstract*—**COVID-19 lockdown affected everybody's economical and mental well-being. This lockdown has confined everybody to their homes as the whole family is staying indoors 24/7. Such confinement has forcefully increased the daily workload of female homemakers. During the lockdown, the female homemakers are forced to do several daily activities like cleaning the dishes several times, sweeping their house every day, washing clothes, taking care of the children, preparing varieties of food, etc. This study mainly focused on the ergonomics perspective of female homemakers in India during the COVID-19 lockdown. To evaluate all these impacts on female homemakers, an online survey was administered with 24 questions formulated from different validated questionnaires such as the International Physical Activity Questionnaire (Part-4) and The World Health Organization Quality of Life (WHOQOL-BREF) Questionnaire. A total of 101 female homemakers with the age range of 28 – 63 years participated in this survey. From the results of the survey, the post-graduate homemakers find significantly ($p<0.05$) tougher to make their children sit for online classes during the lockdown than the undergraduate homemakers. The homemakers of the nuclear family find significantly ($p<0.05$) hectic to disinfect the food supplies and goods than the homemakers of the joint family. The homemakers of the joint family are significantly ($p<0.05$) stressed about taking care of their in-laws during the lockdown than that of nuclear family-based homemakers. The study concludes that the post-graduate homemakers seem to be impatient to make their children sit in front of the online classes. The nuclear family-based homemakers have a hard time disinfecting the goods compared to joint family-based homemakers since there is a division of labor among the family members. On the other hand, the joint family-based homemakers find it difficult to take care of their elders during this lockdown period.

Keywords: COVID-19, Lockdown, Homemakers, Daily workload, Stress**.**

Challenges of Managing Resources during COVID - 19 Pandemic

Neena Vyas[1], Aruna Rana* and Akshita Awasthi[2]
[1]College of Community Science, CSKHPKV Palampur, India, [2]College of Agriculture, CSKHPKV Palampur 176062

***Abstract* —**The outbreak of global health pandemic COVID-19 brought a lot of changes in the lives of mankind and because of this, the country was put under complete lockdown in March 2020. The management of all human and non human resources was a great challenge during this period. A study of assessing management practices during COVID-19 was conducted online from friends, families, located in villages, towns, cities and abroad constituting a sample of 107 respondents coping with this situation. The questionnaire regarding the management practices was formulated keeping in view the practices followed indoors, free time utilization and the advisories followed. It was observed that human energy consumption was increased during the lockdown period during fulfillment of family needs, the government advisories were properly followed by the people eg, and people downloaded the AROGYA SETU app, purchased locally available goods and mostly followed the online transactions. The major recommendation is that people should be motivated /encouraged to follow the safety practices about the COVID-19.

Keywords— Covid -19, Lockdown, Resources, Management practices, advisories

Analysing Metabolic Heat among Metal Casting Workers Using Different Body Surface Area Estimates: A Comparative Study

Milap Sharma[1*], N.M. Suri[2], and Suman Kant[3]
[1]Research Scholar, [2]Professor, Associate Professor, Department of Production & Industrial Engg., Punjab Engineering College, Chandigarh, India (**Corresponding Author* Milapsharma25@ gmail.com)

***Abstract*—**Thermal stress evaluations in a hot and humid work environment also requires estimating the metabolic heat generated from a human body. The estimation of this metabolic heat depends on the physical work activity level and body surface area (BSA) of the targeted audience employed in that particular work environment. Similarly, basal metabolic rate (BMR) provides an estimation for the daily energy expenditure requirements (in Kcal) for maintaining healthy body weight based on the physical work activity level. In this study an attempt was made to evaluate the different BSA estimates from a group of 87 metal casting workers. Five different BSA expressions were evaluated based on the anthropometric variables of casting workers and a comparative analysis among these BSA estimates was performed. The respective BSA and BMR estimates were utilized in evaluating the metabolic heat generated during different physical work activities (based on the metabolic rate for specific foundry work activities, according to ISO 8996 standard) and also the energy expenditure requirements. From the results, it was concluded that there was strong association between the Du-bois and Mosteller BSA estimates (correlation coefficient (r) = .993, at 0.01 significance level). It was observed that there was strong association among the considered BSA estimates (at significance level of 0.01). Although the BMI index showed a better association (r = 0.785) with the Boyd expression as compared to other BSA expressions. The highest metabolic heat was observed for the hand molding work profile (upper limit (UL) varying between 427.08 watts to 431.66 watts) followed by blast furnace work (upper limit (UL) varying between 391.49 watts to 395.69 watts). Also, the average daily energy expenditure requirements based on the BMR estimates was found varying between 2647.18 Kcal to 2699.89 Kcal. These estimates may be considered as an effective tool in evaluating the metabolic heat and further analyzing the thermal ambience for a high-heat work environment

Analysis of Working Postures in a Small Scale Fastener Industry by Rapid Upper Limb Assessment (RULA) using CATIA Software

Nikhilkumar[1], Qutubuddin S.M[2]., Pallavi R.P[3], Avinash Sambrani[4,] Deepika Padashetty[5]
[1, 3&5]Final year students, [2]Associate Professor, [4]Head of Department,
Industrial &Production Engineering, P.D.A.College of Engineering, Kalaburagi, Karnataka, INDIA
(**Corresponding Author* hpnik99@gmail.com)

***Abstract*—**Digital Human Modeling (DHM), has emerged as an important tool in simulation of workplaces to provide better solutions for ergonomic and workstation design. Digital human manikins are incorporated into software, which can be easily manipulated to assess for workstation design, discomfort and related injuries leading to development of musculoskeletal disorders. Workers in small scale industries often complain about pain and discomfort while carrying out the tasks. If not addressed at the initial stages, this may lead to further development of work-related musculoskeletal disorder and other serious issues like Low Back Pain (LBP), affecting the workers efficiency and productivity. The objective of study is to analyse the work postures in small scale fastener industry by Rapid Upper Limb Assessment (RULA) tool in CATIA software. The process consists of cold forging of bolts on header machine, trimming, threading and heat treatment. The operators work postures are assessed using RULA and then the actual postures are reconstructed in CATIA software to find out level of risk. The postures are again reconstructed to show possible improvements using ergonomics intervention. For example, a posture of operator at cold forging machine was assessed by RULA and a score of 7 obtained, meaning high risk. After applying ergonomics intervention and redesign of workstation in CATIA, the improved posture resulted in final RULA score of 4, indicating medium risk. Some of the worst postures are analyzed and improvements suggested based on anthropometry and ergonomic principles. The results show poor working posture risk can be reduced effectively by using ergonomic interventions.

Keywords—Postures, Ergonomics, Musculoskeletal disorder, RULA, CATIA**.**

Foot Impairments and Overuse Injuries in Long Distance Runners-Prevalence and Management

G Vijayan[1], K Muralirajan[2]

[1]Chief Physiotherapist, Rajagiri Hospital, Aluva, Kerala; PhD Scholar, College of Physical Education, Alagappa University, Karaikudi, Tamil Nadu, [2]Professor, College of Physical Education, Alagappa University, Karaikudi, Tamil Nadu

Abstract — Overuse injuries are common in long distance runners. Previous studies have had runners' self-report injuries rather than having a medical professional provide a clear statistics - a major reason for the inconsistencies in reported incident proportion of the overuse injuries in long distance runners. The runners with most prevalent overuse injury was attempted to manage with footwear modification. This study was designed to explain overuse injury prevalence, injury severity and the anatomical location and to find the effectiveness of footwear modification in the most prevalent overuse injury. It was concluded that running-related overuse injuries are highly prevalent in long distance runners, and the most prevalent overuse injury was found to be plantar fasciitis. The shoe modification done with prefabricated insoles was found to be very effective in managing the plantar fasciitis in runners which with flat foot which was found more prevalent. Future injury prevention studies in long distance runners should focus on these areas.

Intervention Study on Design of Hand Tool-Hammer used in Bell Metal Industry in Assam

Chauhan M.K.[1] Sarma D.[2] and Patel P[3]

[1]Associate Professor, Department of Resource Management, SNDT Women's University, [2]M.Sc Resource Management and Ergonomics, Department of Resource Management, SNDTWU, Mumbai., [3]Assistant Professor, Sir Vithaldas Thackersey College of Home Science, SNDT Women's University, Mumbai. (**Corresponding Author:* manjit.chauhan@resourcem.sndt.ac.in)

Abstract — Most handicraft workers use traditional hand tools since ages. Extensive use of these hand tools over the years have increased the risk of occupational disorders and injuries. This research attempts to study the problems related to hand tools used by workers from the largest Bell Metal Industry situated in the districts of Assam and conduct an intervention study by designing prototypes.

Methodology: A descriptive survey was conducted on 30 male artisans involved in forging activity using an interview and questionnaire; in order to know the hand tool design related problems and to evaluate the new designed prototype I & II using McNemar test. With respect to MSD problems, the majority of the forging activity workers reported discomfort in shoulder (93.3%) and upper limbs (86.7%). In forging, 50- 60 % workers felt that the hammer 'handle diameter was not comfortable', 'finger grip uncomfortable', 'needed more pressure to operate', 'fit in hand was not good', 'size of the handle was not comfortable' and 'handle too hard'. 67-73 % of workers reported the 'shape of the handle not good', 'contact point stress created at handle' and 'tool is heavy in weight'. 80 % of the workers complained that the existing Handle Length was long and the handle finish was rough. Thus the intervention study was carried out for five parameters of the tool-hammer for redesigning: rough finish, weight of tool, contact point stress, handle length, and force exerted while using the tool. Based on the design problems in the existing hammer, 2 prototypes were developed and tested. The McNemar test further supported that the new prototype design I and II were better and significantly reduced the problems associated with the existing hammer design.

Keywords— Hand Tools, Bell Metal Industry, Forging, Polishing, hammer.

Influence of Weights for Selected Cognitive Abilities: An Online Approach

Giridhar M. P. and Vinay V. Panicker

Abstract — The existing literature emphasizes the importance of cognitive abilities in performing a specific task. However, an experimental study to identify the importance of these abilities and their order of preferences has received limited attention. A detailed assessment in a virtual environment with subjects performing online is also a new technique for cognitive ability assessment. Each cognitive ability comprises certain tasks which are given specific scores; thereby a total score is given to individual for all the eight cognitive skills considered. A multi-criteria decision analysis was conducted to identify the variation in the performance index of subjects. This research compares the weights of the individual cognitive abilities of fifteen subjects using Wilcoxon test. A total score suitable for our study was obtained with a pilot study previously conducted. The results prove that the method of study can be used for assessment of cognitive skills and further worker allocation based on the skills can also be accomplished. The appropriate work station design with complex robot mechanisms can be considered as a major application in this field of study

Weapon Firing Training for Security Forces: Study Review

KCP Paraasaram[1], Urmi R. Salve[2]
[1, 2] Department of Design, Indian Institute of Technology Guwahati, Guwahati
(*Corresponding Author: kcpvsl@gmail.com)

***Abstract*—** The ability of soldiers to fire at enemy (targets) with appreciable accuracy is one of the important criteria that affects the outcome of any offensive or defensive operations. Weapon Firing Training at ab-initio stage as well as periodic continuity training plays a pivotal role towards this.
The National Threat Perception has changed at a rapid pace with the evolving times. A demanding necessity to cope up with ever changing war waging tactics coupled with the simmering unrest amongst a few groups of errant personnel in few pockets of the country has shifted the focus of security preparedness from conventional battle techniques to that of effectively countering localised surprise terror attacks or suicidal missions, which are highly unpredictable. Effectively, the modern day's challenge is to have a strategy /system, capable to serve as an effective counter mechanism against surprise, localised, high intensity conflicts for short duration vis-à-vis a conventional war tactics on a battle field.
Further, the unexpected & unprecedented terrorist attacks on military stations and the brutal ambushes on security convoys, re-iterates the necessity to ensure that defence personnel of all branches need to be combat effective, not just the infantry & artillery (fighting arms). In this context, this paper reviews the existing training system on weapon firing techniques with respect to its efficacy to achieve the above requirement and suggest suitable alternates.

***Keywords*—**Weapon Firing Training for Indian Soldiers, Changing National Threat Perception, Counter-Insurgency Operations: India.

Evaluation of Directional Control-Response Stereotype among The Population of Eastern Zone of India

Piyali Sengupta[1], Monalisha Banerjee[1], Prakash C Dhara[1]
Ergonomics and Sports Physiology Division, Department of Human Physiology with Community Health, Vidyasagar

***Abstract*—**In the present study an attempt was made to evaluate the directional control response stereotype among the population of Eastern India. It was also aimed to assess the influence of gender, different regions (states) and educational status on directional control response stereotype. The study was conducted in different areas of Eastern zone of India. Four states were selected for the study i.e. West Bengal (WB), Bihar (BR), Jharkhand (JR) and Orissa (OR). 4885 subjects were selected for the study having the age range 18-60 years from random sampling method. The subjects were further classified in different groups. To assess the directional control response stereotype different stereotype models were prepared. A questionnaire was prepared to evaluate educational status. Statistical analyses were done by performing mean and standard deviation (SD) in Microsoft Excel. Chi-square tests were performed for categorical variables. The results of the present study showed that the percentage (in females-32.2%, in males 18.4%) of illiteracy was higher in females than in males. There was a gender difference of directional control response stereotype among the selected population. A relatively larger percentage (77.1%, 80.6% and 79.5% for horizontal, circular and vertical display respectively) of the subjects moved the rotary control in clockwise direction for the rightward movement of analog pointer in horizontal and circular displays and for the upward movement of the pointer in case of vertical display. State-wise variation was noted for all the models of control response stereotype. For all the three stereotype models percentage respondents were highest from Bihar (86.4%, 78.3% and 87.8% for horizontal, vertical and circular display respectively) and Jharkhand (79.2%, 91.4% and 89.5% for horizontal, vertical and circular display respectively) states for clockwise actions while operating the knob right side and upward. The findings of the present study concluded that a higher percentage (77.1%, 79.5% and 80.6% for horizontal, vertical and circular display respectively) of the selected population were habituated for controlling a rotary knob in clockwise direction to move the pointer upward and/or right side. There was an influence of gender on directional control response stereotype among the population of eastern India. The study also concluded that the directional control response stereotype is different in deferent regions of India. It may be concluded from the study that the educational status had an emphasis on population stereotype. (In abstract instead of using higher or lower, exact percent should be used: corrections made wherever needed)

Identifying Ergonomic Risk Factors in a Drilling Task: A Literature Review

Umair Arif[1*], Saman Ahmad[1]
[1]Ergonomic Research Division. Department of Mechanical Engineering, Z.H.C.E.T, Aligarh Muslim University, Aligarh, UP, India. *(Corresponding Author: umairarif@zhcet.ac.in)

Abstract—Due to growing need of ergonomic design in industries, the present study aims at identifying ergonomic practices and design parameters that contribute towards worker productivity and health in a drilling task, through a literature review. 36 peer-reviewed research papers were identified through a screening process for this study. Almost 40% of the studies analyzed focused on ergonomic intervention for assisting the drilling task. Factors such as wrist flexion, shoulder flexion, age, gender, tool vibration, drilling speed, duty cycle, level of adjustability, models for predicting posture and support systems were found to have a bearing on a drilling task. It was observed that further studies are required for designing an overhead drilling task in horizontal direction. Drilling speed, tool mass and their effect on human health and performance is another area where more research is required. This study attempts to identify the research gaps in the ergonomics of a drilling task and enhance awareness of the risk factors involved in drilling tasks.

Product Design Intervention to Solve Issues Faced by Construction Workers in Glass Cleaning Activity

Reenu Singh[1*], Rauf Iqbal[1], Ashok K. Pundir[1]
[1]National Institute of Industrial Engineering, Vihar Lake Marg, Powai, Mumbai. (*Corresponding Author: reenu.singh.2016@nitie.ac.in)

Abstract **—**Unskilled workers of Indian construction industry constitute to about 48% of the total construction workforce. Mechanization and automation have greatly impacted the efficiency of construction stages of site planning and building of super structure. However, cleaning and finishing work is rather a manual job which requires human power. Very few studies in the literature are focused on ergonomic issues faced by construction workers. Among the finishing workers, the occupational physical stress of glass cleaning workers of high-rise buildings has been neglected in ergonomic studies. There is a need to focus on task study and problem solving for the workers. The paper consists of the task study of glass cleaning activity at a high-rise residential building in Mumbai. The insights gathered from the study helped in ideation of a product entity which aims to potentially reduce physical stress of the manual glass cleaning workers.

Vibration Exposure Analysis among Two Wheeler Riders in Kerala

Mathew John[1], Jithu Gopinath[1], and S. A. Binoosh[2*]
[1]Scholar, College of Engineering Trivandrum, [2]Associate Professor of Mechanical Engineering Department in College of Engineering Trivandrum, Thiruvananthapuram, Kerala, India (*Corresponding Author: binoosh@cet.ac.in)

Abstract**—**Two-wheelers are one of the most commonly used public transportation mode in Kerala. Two-wheeler riders are exposed to hand arm vibration (HAV) and whole body vibration (WBV) during their riding due to varying road conditions. HAV exposure occurs when rider controls the vehicle and WBV occurs when driving through irregularities in the road. This study aims to quantify HAV and WBV exposures among two- wheeler riders during their travel on different road conditions and with different suspension types in the vehicle. It also attempts to explore the effect of pillion rider on these exposures. Qualitative risk assessment using modified Nordic questionnaire and odd ratio test were conducted to identify the severity of disorders felt by the riders. Quantitative vibration exposures are measured using accelerometers and an Arduino based data acquisition system as per ISO guidelines. Exposure levels obtained from the experiment were assessed with standard limit values proposed by European directive 2002/44/EC standards. Results of qualitative risk assessment showed discomfort in upper extremities and lower back of the riders. WBV exposure is more severe compared to HAV in both type of suspension bikes and has exceeded the standard limit values. The result also revealed that the pillion rider presence can reduce WBV exposure on rider whereas pillion rider doesn't have any influence over HAV exposure. The presence of irregularities in road surface has significant influence on both WBV and HAV. Time duration in years required for producing hand arm vibration syndromes in dual shock bike users were found to be lower than the mono shock bike users. WBV exposure was found to be severe, which act as the causal factor for the discomfort felt in lower back and neck. However, HAV exposure doesn't have influence over the pain felt in upper distal extremities. This can be attributed to other health hazards like repetitive strain injuries.

Musculoskeletal Disorder and Body Parts Discomfort of Farm Women in Paddy Storage Activity of Assam

M. Kalita[1*], R. Borah[1], and N. Bhattacharyya[1]
[1]Assam Agricultural University, Dept. of Family Resource Management and Consumer Science, College of Community Science, AAU, Jorhat-13, *(Corresponding Author: mirakalita72@yahoo.com)

***Abstract* —** Poor work posture constitute one of the main risk factors for work related musculoskeletal disorders (WMSDs), ranging from minor back problems to severe handicapping. A considerable number of adverse health conditions, including musculoskeletal disorders are linked to agricultural work. Assessment of exposure levels to MSDs risk factors can be an appropriate base for planning and implementing interventional ergonomics programs in the workplace. An attempt was made to assess musculoskeletal disorders (MSDs), body parts discomfort (BPD) and grip strength of farm women while performing the paddy storage activity. For the purpose of the study thirty subjects in the age group of 25-35 years who are having normal, non-pregnant, and non-lactating were selected. To ascertain the musculoskeletal problems of farm women Nordic Musculoskeletal Questionnaire (NMQ) a 5 point scale, ranging from 'very severe', to 'very mild' was used. Body parts discomfort Scale was used in identifying the zones of discomfort in different body parts [1]. Grip strength of the farm women was measured by using Grip Dynamometer. The farm women had 'very severe' pain in shoulder (86.66%), low back (80%), upper back (76.66%), leg (73.33%) and ankle (70%). Farm women also experienced 'severe' to 'moderate' type of pain in hands (83.33%), wrist (56.66%), upper arm (46.66%), calf muscles (43.33%) and knees (43.33%). Farm women experienced more discomfort in the upper parts of the body, such as the head, neck, shoulders, arms etc. than that of the lower body parts. The left hand of the respondents had more grip strength (13) than right hand (12.85).
***Keywords*-** WMSDs, Body Parts Discomfort, Grip Strength.

A Survey on Early Prediction of Autism Spectrum Disorder using Supervised Machine Learning Methods

Praveena K N[1], Mahalakshmi R[2]
Department of Computer Science and Engineering, Presidency University, Bengaluru, India
*(Corresponding Author: praveenakn@presidencyuniversity.in)

Abstract—Autism is a neurobehavioral problem that debilitates the capacity to convey and interact with others [5]. Autistic Spectrum Disorder (ASD) is a mental disorder that hinders procurement of etymological, communication, cognitive, social skills and Stereotypical motor behaviours and capabilities. In the previous decades, ASD has been searched by public and computational intelligence scientists exploiting innovative technologies like machine learning for early prediction and hence to reduce the diagnostic timing, with high precision, enhanced quality of diagnosis. Machine learning is a multidisciplinary research field that employs intelligent techniques in the form of algorithm to determine beneficial secret outlines, which are subjugated in prediction to enhance the decision making. The strategies of Machine learning like help vector machines, choice trees, calculated relapses, and others have been applied to datasets identified with chemical imbalance to theory prescient models. These models privilege to enrich the capability of Doctors to provide healthy diagnoses and predictions of ASD. This paper gives an extensive audit of not many papers utilizing administered AI in ASD which incorporates calculations for arrangement and forecast. The aim of the paper is to describe the different supervised machine learning techniques which is suitable for early prediction of ASD.
Keywords— Autism Spectrum Disorder, Machine Learning techniques, Supervised Machine learning algorithms.

A Preliminary Study on Female Runners and Their Body Composition

Ekta Kapri[1], Ekta Melkani[2] Manju Mehta[3] D.K.Sharma[4]
[1]Deptt. of Family resource management,COHS,CCSHAU, [2]Deptt. of Family resource management,COHS,CCSHAU,
[3]Deptt. of Family resource management,COHS,CCSHAU, [4]Deptt. of AP&FE,COA&E, CCSHAU
(*Corresponding Author: etikaprirai@gmail.com)

***Abstract*—**Running is one of the most common sports activities for both athletics and nonathletic person. Regular physical exercises such as running, throwing and jumping, increase rate of physical development, and boosts athletic performance. In the high-level competitions, anthropometric profiles indicate whether or not the athlete would be suitable for the competition. The study aimed to examine the type of runners and the association among anthropometric parameters of the female runners. The study had been conducted on the female runners in the campus of CCSHAU, Hisar, Haryana. Twenty female students were selected. On the basis of the interview schedule, out of these twenty runners, five competitive runners were purposively selected based on their running practice, physical health, and involvement in the university athletic competitions. Anthropometric data were collected and calculated by using anthropometric formulas and methods. Anthropometric assessment of the competitive runner includes body weight, height, and skinfolds measurement. Study revealed that 35% was a beginner and they had started running from the last two months to six months. 35% were competitive runners and practicing running from at least two years up to six-year. Out of 35%, competitive runners 20% were sprint runners (100 & 200 mt.) and 15% were middle-distance runners (1500mt.). 60% of female runners were having a height in between 1.6-1.7 mt followed by 1.5-1.6 mt (35%) and 1.7-1.8 mt (5%). Runners fall into normal weight category (19.55 ±1.35 kg/m^2) and mean fat percentage of female runners was found 15.12±2.56 %. In respect to the weight and height, BMI fall into the normal category. Age, weight, and BMI positively correlated with fat%, fat weight, and lean body mass.

Impact of Symbology Luminance and Task Complexity on Visual Fatigue in AR Environments

Prerita Kalra[1] , Vinod Karar[2]
[1]Academy of Scientific & Innovative Research, CSIR- Central Scientific Instruments Organisation, Chandigarh, India.
[2]Vinod Karar is with the Academy of Scientific & Innovative Research, CSIR – Central Scientific Instruments Organisation, Chandigarh, India (*Corresponding Author: prerita_chd@yahoo.com).

Abstract—A number of sectors such as healthcare, aviation, military and gaming are making use of the augmented reality (AR) technology for task assistance. The complexity of these tasks depends on various features of the AR application. The varying levels of task complexity require different degrees of visual attention from the task performer thereby affecting the extent of visual fatigue induced. The human visual system is also affected by the luminance of the symbology presented on the AR display. The luminance of the symbology, if not in accordance with the ambient lighting, can lead to high levels of visual fatigue. This study was aimed at studying the impact of symbology luminance and task complexity on visual fatigue and human performance while working in AR environments. A head up display based game with varying symbology luminance and different complexity levels was used for this study. The correlation between the independent variables- symbology luminance, task complexity and the dependent variables- visual fatigue, human performance was studied. Recommendations for the design of AR based tasks have also been proposed.

Protection Warning System In Indian Railways

Mrs Arathi B N[1], Mrs. Pankaja R[2]
Assistant Professor[1,2], Department of Computer Science and Engineering, Sri Venkateshwara College of Engineering, Bengaluru-562157

Abstract—The presented methodology is to automate monitoring of railway gates using Raspberry Pi and also monitoring of humans and animals near railway crossings using Object Detection techniques. Detection of train approaching and leaving the gate can be sensed by means of two sensors placed on either side of the gate. The sensors on receiving signals from the approaching trains will control the gates with the help of DC motors. Light signals and Buzzers are used for alerting the people near the level crossing. A camera is used to capture images and monitor the movements of humans and animals near the crossings. This feed will be fed into a SSD object detection algorithm that will detect human and animals in the feed. Once humans and animals has been detected on the track or in the vicinity of the tracks, an alert sound is made using buzzer from the approaching train.This might effectively reduce the collisions of train with both animals and humans and solve the problem of railway accidents.

Keywords—Raspberry Pi, Ultrasonic sensor, Camera, DC Motor, Buzzer, Light Signals, Python IDLE, Putty.

Occupational Health Hazards Associated With Fish Dressing Operation: A Case Study of Ratnagiri Fishing Harbour

J. K. Khurdal[1], V. V. Aware[1], A. U. Pagarkar[2], P.U.Shahare[1] , R. R. Potdar3, S.V. Aware[1]
[1]Department of Farm Machinery and Power Engineering, College of Agricultural Engineering and Technology (Dr. B. S. Konkan Krishi Vidyapeeth), Dapoli, India
[2]College of Fisheries, (Dr. B. S. Konkan Krishi Vidyapeeth), Shirgaon, Ratnagiri, M.S., India
[3]Agricultural Mechnization Division, ICAR-Central Institute of Agricultural Engineering, Bhopal-462038.

Abstract—Fish dressing is a seasonal activity in seacoast regions. Work related health hazards of women in fish dressing (N=68) were examined using ergonomic checklist, including workplace description, workers description and ergonomic aspects in fish dressing. Working with traditional method of fish dressing, 91.2 per cent women workers suffered from back pain, 85.3 per cent from leg pain, 89.7 per cent from body pain, 83.8 per cent from knee pain and 77.9 per cent from neck pain. Also, 73.5 per cent had skin related problems, 25 per cent had respiratory irritation, 82.3 per cent had a headache and 55.9 per cent had frequent hand injuries. These occupational health hazards were due to the handling of fish material, long hours of sitting work, fixed and awkward work posture, working with arms away from the body, improper workplace design etc.

Keywords—Women workers, occupational health hazards, workplace.

Postural Assessment of Women Workers Involved in Various Handloom Activities

G. Bori[1*] and N. Bhattacharyya[1]
[1] Assam Agricultural University, Department of Family Resource management and consumer science, Jorhat, Assam, India
*(Corresponding Author: geetashree_bori@yahoo.co.in)

***Abstract*—**Women workers are involved in various activities in handloom industries starting from spinning to weaving. While performing these activities they require to maintain some postures for a long period of time with high postural load due to constrain of work method and working condition and in the long run result in overusing of muscles, tendons, joints and nerves. According to fourth handloom census (2019-20), 91.8 percent of women workers of Assam are involved in weaving and allied activities. This unnatural posture if maintained for a long period of time, the workers may experience health related problems, leading to reduce productivity and early retirement. Therefore, to improve their working condition and enhance the performance of work there is a need to assess their working posture involved in various handloom activities. The present study was undertaken to assess the working posture of women workers involved in various handloom activities. Data were collected by interview method, photography, video recording and observation of work practices. A total of 60 workers were taken for the study from Lakhimpur district of Assam. Postural assessment was done by using ergonomic tools: RULA and Strain Index. Awkward postures were observed in the handloom workers. The mean RULA score was found highest in weaving activity with 6.41±0.49 followed by warping, spinning. Strain Index was found highest in the right hand and left hand of weaving activity. High occupational risk was found in the activities. Therefore application of ergonomics would help in reducing the postural exertion.
Keywords—Handloom activities, Women workers, Ergonomics

Ergonomically Design of Manually Operated Farm Equipment for Central Agro-Climatic Zone of Uttar Pradesh

Tarun Kumar Maheshwari[1] and Devendra Kumar[2]
AP, FMP, CAET, Etawah MP

Abstract— Engineering anthropometry is the effort to apply such data to equipment, workplace and clothing design to enhance the efficiency, safety and comfort of the operator. The data were collected from Central Uttar Pradesh, keeping into consideration the requirements of hand tools and machines, anthropometric measurement of the identified 79 body dimensions and 16 strength parameters of 350 Male and 250 female farm workers have been done. The anthropometric data are used to determine the size and shape of handles, height of work surfaces and the space in which an operator has to work. A typical hand tool/equipment consists of the fictional part, handle and a connecting part. The design of the handle depends on the mode of operation and amount of effort required, anthropometric data of working population, handle material etc. It is not enough, as a rule, to design a work place to suit an average person. Since, it is not usually possible to design work place to suit the tallest or shortest workers, one has to be content by meeting the requirement of the majority i.e. 90% of the population (i.e. people having values between 5th and 95th percentile for the particular dimensions.). While operating the thresher, So that the maximum permissible height for feeding chute should be decided considering the 5th percentile value of acromion height and from this data its value is 129.4 cm. For better operation and more human comfort a proper handle height for these equipments will be between 63.7 to 95.8 cm with 63.7 cm being the 5^{th} percentile value for metacarpal height and 95.8 cm being the 5^{th} percentile of elbow height From recorded value of body dimensions the mean value, standard deviation, 5^{th} and 95^{th} percentile values were computed and recorded for male and female subjects respectively.

Cost Effective Portable Non-Invasive System for Prediction of Liver Cirrhosis

Rajkumar E R[1], Latika. V[1], Ritvik Kumar P Venkatesh B[1]
[1]RBG Labs, Engineering Design Department, IIT Madras.

Abstract—Liver cirrhosis is a major cause of death worldwide. According to the most recent report of the global, regional, and national burden of liver cirrhosis by cause in 195 countries and territories 1990–2017, liver cirrhosis related deaths constitute 2.4% of total deaths globally in 2017 as compared to 1.9% in 1990; the number of liver cirrhosis related deaths globally is also increased from less than 899000 deaths in 1990 to more than 1.32 million deaths in 2017. In this paper, new design has been proposed using laser backscattering technique for early detection liver cirrhosis. This design is basically the non-invasive method for estimating the optical properties of internal organs by localization and characterization. The technique consists of three basic parts. Multiple monochromatic light sources and different wavelengths via switching diodes, Optical fiber, Photo detector, Using normalized backscattered intensity (NBI) profiles at various locations of liver are obtained. These data are obtained after digitization, interpolation, and filtering. Corresponding to the variation of NBI over the liver region the optical parameters show their respective changes. The maximum absorption and minimum scattering coefficients are observed. To visualize the liver region, the color-coded scheme of the NBI variation, as measured by fibers is further expanded. This technique is aimed to find out changes in localized target liver by optical backscattering technique with 670nm and 720nm wavelength laser diodes. The radiations from array of laser sources is incident upon the concerned region of the liver. The laser diode (670nm and 720nm wavelength) be the ideal wavelengths for this purpose. The photo-detector array to be arranged to collect the information from the source. The Preliminary design is being developed and This optical technique made significant contribution in characterization of tissues. Through fluorescence measurement, structural and functional details could be observed. This multi probe can receive backscattered radiation from various depths below the skin layer could be utilized to obtain the structural details precisely.

Performance Evaluation of Knapsack Type Roto Paddy Weeder

P. U. Shahare, V. K. B. Phalphale, V.V. Aware And S. V. Pathak
Department of Farm Machinery and Power Collage of Agricultural Engineering and Technology
Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Maharashtra email:shahare_prashant@rediffmal.com

Abstract—Weeding is the more tedious task of all the labour stages in the farming cycle. To reduce the cost, work stress and drudgery, considering portability, easy handling and small field size of Konkan region, a knapsack type roto paddy weeder was developed. It consists of engine, flexible and rigid shaft, worm gear box, rotor with blade, frame, handle, rotor shaft, throttle lever, mud flap and backpack frame. Weeds cause most yield loss within the first 20–50 days after crop establishment. Hence the developed power weeder was tested after 30 days after of transplantation using the three types of rotors viz. rotor with 4 L shape blade, rotor with 6 L shape blades and rotor with serrated- flat blades. Its performance was studied for weeding efficiency, plant damage, field capacity and fuel consumption. Its performance was also studied ergonomically. The highest weeding efficiency of 88.24% was found with rotor having serrated - flat blade which was 7.25 % and 11.69 % higher than rotor with 6 L shape blades and 4 L shape blade respectively. The rotor with 4 L shape blade had resulted fuel consumption of 0.63 l/h which was 10.79 % and 22.59 % less over rotor with 6 L shape blade and serrated-flat blade respectively. The maximum field capacity of 0.034 ha/h was found with rotor with 4-L shape. Considering weeding is the major function of power weeder, the rotor with serrated - flat blades was found to be better over rotor having 4-L shape blade and 6-L shape blade which gives highest weeding efficiency. The developed machine was also tested ergonomically. Six subjects of similar age group and posture were selected during the ergonomic evaluation of developed sprayer. The maximum heart rate of the group was in the range of 180-192 with the corresponding maximum aerobic capacity in the range of 2.36- 3.08 l/min. The mean HR max and mean VO2 max value for the subject were 188 (±4.68) and 2.64 (±0.24) l/min respectively. The average working heart rate (WHR) value of the subjects found in the range between 111.8-129.45 bpm with mean 122.45(±7.03).

A study on Women Police Bullet-proof Jacket considering Anthropometry data, Comfort and Safety in Pune, India

Chinmayanand Prakash Jagtap[1], Shilpi Bora[2], Pranjal Arun Patil[3], Abhijeet Malge[4], Mahesh Goudar[5]
[1.3.5] School of Mechanical Engineering, [2,4]School of Design, MIT
Academy of Engineering (MITAOE), Pune, Maharashtra, India

Abstract—An effective study held with a survey carried out by interacting with a number of lady police about the current Bullet Proof vest available, which are bullet resistant to a particular threat level. These are not manufactured according to the concern of women. This study helps in figuring out the need for a new bullet proof vest for women. The survey gave many aspects which need to be changed. The paper flows by briefing today's availability and condition for women's working in various defense sectors. With current scenarios and the changes need to be done with the women police personnel located in Pune district of Maharashtra state. A motive for designing a bullet proof vest for women is basically giving them equal importance, comfort, joy and stress free duty while serving for the nation. A questionnaire was developed for the survey analysis of 15 women police in Pune district. The development of the armour which can provide better protection considering comfort, weight, fitness as major factors is a demand. As a result of this study the need of improving the armour led to various design changes like the section under the arm, neck portion, weight reduction. These were the major aspects of the reforming strike by the women police.

Grid Based Blind Spot Analysis for Indian Driver Anthropometry

G. Rajkumar[1], K. Rathanakumar[2]
[1]Assistant Professor, Department of Automobile Engineering, Kumaraguru College of Technology, Coimbatore, Tamil Nadu, India, [2]Department of Mechanical Engineering National Institute of Technology, Calicut, Kerala, India.

***Abstract*—** Increased vehicle population in the developing economies has created a serious road safety challenge in the recent times. World Health Organization report on road safety submitted in 2013 states that the road fatalities per lakh of motor vehicle is found to be 130.1 for India and 104.5 for China. These alarming facts signify the importance of designing and developing the safe vehicles in India. Among many aspects, the design and development of driver cabin is considered as a crucial part to impart active and passive safety in the operation of the vehicle. Driver visibility and accessibility to various controls systems within the driver cabin plays a vital role in safe driving of the vehicle. By enhancing the driver visibility through improved driver cabin design will decrease many human errors. This paper deals with the detailed study and assessment of blind spot in four-wheeler for Indian drivers and to maximize the visibility by enhancing the ergonomics of the driver cabin. The 360-degree Field View Grid based analysis is carried out for top selling Indian model four wheelers to understand the visibility curve of Indian anthropometry. The above findings and result found to be alarming regarding the visibility capabilities. The test was carried out for A2 segment top setting Indian model vehicles such as Alto and Maruti swift and A3 segment Nissan sunny. The experiment findings state that nearly 40% of the area around the vehicle claims to be falling under blind spot zone from the driver cabin in spite of sidemirrors and rearview mirror. The smart all-weather night vision rear view camera integrated with an dedicated driver display monitor has been installed in the vehicles to understand the visibility improvements in this low cost top selling vehicles. The grid mapping shown an average of 30% decrease in the Blind spot area. The overall cost and installation of the product seems to be quite cheaper whereas the contribution to driver safety is exponentially high.

Dynamic Analysis of Load Carriage on Physiology and Biomechanics during Simulated Terrain walking: A Continuous Observational approach

Anilendu Pramanik[1], Deepti Majumdar[2], Tirthankar Chatterjee[2], Bodhisattwa Chowdhury[2] and Dhurjati Majumdar[2]

[1]Guru Nanak Dev University, Amritsar, Punjab, India, [2]DIPAS, DRDO, New Delhi, India

(*Corresponding Author: anipapu@gmail.com)

Abstract— Army personnel in mountainous environment regularly undergo load carriage operations in undulating terrains. The present study aimed to investigate and correlate the physiological and biomechanical responses of moderately heavy backpack (BP) load carriage dynamics during continuous uphill and downhill walking at different gradients. Twelve physically fit, male Indian infantry soldiers were subjected to continuous treadmill walking at 0, 5, 10, 15 and 20% of uphill and downhill gradients, with a constant speed of 3 km/h. During walking, they carried 0, 10.7 and 21.4 kg of load added to their backpack frame. Physiological parameters like oxygen consumption (VO_2), heart rate (HR), energy expenditure (EE) was measured breath by breath using K4b2 system. Biomechanical variables including spatiotemporal, angular and range of motion (ROM) parameters were evaluated by 6 retroreflective camera-based 3D motion analysis system (3DMAS), throughout the test. Further, Pearson correlation analysis was conducted between physiological and biomechanical variables observed. Results of the present study revealed significant alteration of both physiological and spatiotemporal, angular, ROM variables of gait, in response to continuous gradient walking with different loads. All physiological variables were gradually increased with uphill load carriage and decreased with declining the gradients. On the other hand, load carriage task at gradients elicited several biomechanical responses including alteration in cadence, double support time, hip and knee joint angles and hip ROM. However, metabolic load actively depends on development of mechanical stress by alteration of kinematic and kinetic factors, the considerable observation, in response to load, was alteration in carriers' posture as indicated by significant increase in forward lean. The ultimate goal of most of such biomechanical changes was to improve the postural stability, by repositioning of centre of mass, for successful completion of the task. Further correlation analysis revealed that most of the physiological variables exhibit significant correlation with biomechanical variables.

Steering Effort of Female Agricultural Workers of Central India

[**,a]Rahul Rajaram Potdar, [b]Champat Raj Mehta, [c]Bhaskar Bharat Gaikwad,[d]Kamal Nayan Agrawal and [e]Laxman Punjaji Gite

** Corresponding author: rrpotdar@gmail.com, [a]Scientist, AMD, ICAR-CIAE, ICAR-CIAE, Bhopal, [b]Director, ICAR-CIAE, Bhopal, [c]Scientist, SASM, ICAR-NIASM, Baramati, [d]Project Coordinator, ESA Scheme, ICAR-CIAE, Bhopal, [e]Ex-Project Coordinator, ESA Scheme, ICAR-CIAE, Bhopal

***Abstract*—** The actuating force of steering wheel on tractors is decided based on the operators' capability to produce the effort in terms of steering torque. The steering strength of the operators varies according to age, sex, race, health, nutrients in the diet apart from the location and size of steering wheel. The present study is aimed to quantify the maximum steering torque of female agricultural workers of central India. The steering torque data of 10 female agricultural workers were measured at different horizontal, vertical and angular locations of steering wheel with respect to seat reference point (SRP) using CIAE-strength measurement setup. The data were collected at five horizontal locations of steering wheel i.e. 30, 33, 36, 39 and 42 % of stature, four vertical locations i.e. 10, 15, 20, 25 and 30 % of stature and five angular locations of steering column with horizontal i.e. 50˚, 55˚, 60˚, 65˚ and 70˚ with respect to SRP. The maximum steering effort of 48.5 Nm was observed at a combination of angular position of steering column of 70˚ with horizontal along with the centre of steering wheel at the horizontal and vertical position of 36 % and 20 % of stature, respectively. It was observed that the steering torque significantly varied ($p<0.01$) with the variation in angular, vertical and horizontal location of steering wheel. The horizontal position of steering wheel significantly affected the steering effort most. For comfortable operation of tractors by female operators, the centre of steering wheel should be located at 457-570 mm forward and 276-470 mm above SRP. Based on the 5th percentile data of steering torque, the recommended actuation force limit is 49 N on a steering wheel of diameter 420 mm.

Keywords: Tractor, Seat reference point, Stature, Steering strength, Female Agricultural workers

Ergonomic Study of the Cleaning Workers to Identify the Prevalence of Musculoskeletal Disorders in India

Neelesh K. Sharma, Mayank Tiwari, Atul Thakur, Anindya K. Ganguli

Mechanical Engineering Department, Indian Institute of Technology, Patna, India

***Abstract*—**Commercial cleaning is a part of the daily routine for professional workers to maintain sanitation in and around the working environment. The clean and hygienic workplace also promotes the productivity, quality, and well-being of the working staff and officials. However, this administrative and waste services sector is prone to musculoskeletal disorders (MSDs) due to repetitive load, overexertion with uncomfortable postures for an extended period. The present paper aims to recognize problems, assess the ergonomic risk factors, and recommend practices associated with cleaning workers in India. For this study, a self-reporting-based assessment was conducted on ninety-four workers using a modified Nordic questionnaire. Chi-square test-based statistical analysis was implemented on the data accumulated through the survey to identify the association of perceived pain with the workload. The electrocardiography (ECG) technique was used to quantify th physiological workload/cost through work pulse value. The software-based biomechanical analysis was accomplished through the stills and visual documentation accumulated during the manual cleaning operations. Rapid Entire Body Assessment (REBA) posture evaluation tool was also included to identify the awkward working posture. Salient findings from the feedback revealed that musculoskeletal disorder risk was prominent among workers, reported majorly in the lower back (48.39%), knee (31.18%), and neck (24.73%). A significant association was found between gender and exercise habits with MSDs. Scraping and sweeping with dumping activity were categorized as tasks with a heavy physiological workload.

H. J. Thim Trust established Theem College of Engineering in 2009 at Boisar with an objective of "Success... through Quality Education" for the development of youths who plays a decisive role in shaping the destinies of nation. The institute's serene and tranquil surroundings create a carnival atmosphere to develop students' overall growth in technical education as well as humanities.

Theem College of Engineering is approved by AICTE, Government of Maharashtra and DTE, and affiliated to University of Mumbai. The institute is awarded with B+ grade by NAAC. The institute is a remote centre of IITB-NMEICT (MHRD, Govt. of India). The institute is emerged as the only Premier Engineering College in Boisar with an overall intake of 480 students in the graduate engineering programmes of Computer, Computer Science (AI& ML), IT, Electronics and Telecommunication, Mechanical, Civil, Automobile, and Electrical.

In addition to this the institute has 240 intakes in the diploma engineering programmes of Computer, Mechanical, Civil and Electrical.

The institute's well-maintained infrastructure, rich academic excellence and teaching-learning ecosystem steer students to achieve their engineering skills and career goals. To enhance multi-tasking growth, the institute equally focuses on co-curricular and extra-curricular activities which yielded university rank holders and winners of various technical and sports events.

ISBN 978-93-5419-847-2
9789354198472