

Ergonomic Assessment of Postural Load and Workstation Design using CATIA in Small Scale Aluminum Utensil Manufacturing Industries

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Abstract

The implementation of Ergonomics principles in small scale industries (SSIs) helps to overcome the issues related to musculoskeletal disorders, postural stress, overall work environment and layout. In most of the SSIs several ergonomic deficiencies are found to exist such as bad workstation design, postural stress, incompatibility between workers and equipment, excessive noise, heat and poor illumination, layout problems and prevalence of musculoskeletal disorders. The objective of the present study is to identify the ergonomic deficiencies in SSI aluminum utensil manufacturing industries in Karnataka, and to suggest suitable low cost ergonomic interventions for reducing the worker discomfort and productivity improvement. A preliminary study and observations revealed the workers are exposed to postural stress due to repetitive tasks involving bending, twisting, load carrying, stretching, contact stress, noise and vibrations. The industry also suffered from bad layout design resulting in unnecessary delays, bottlenecks and backtracking. The work consists of melting, rolling, sheet cutting, press work, trimming, polishing and packaging which involve frequent bending, twisting, stretching, and contact stress, carrying load, vibrations and excessive noise. The methodology adapted for the study includes administering modified Body Discomfort Survey, ergonomic assessment tools like Rapid Upper Limb Assessment (RULA), Rapid Entire Body Assessment (REBA) and Digital Human Modeling using CATIA. The results of body discomfort survey indicated discomfort in the range of 60% to 80% in upper back, shoulder, lower back, wrist and elbows. The RULA analysis showed around 48% of postures assessed are in high risk and REBA analysis showed about 55% postures are in high and very high risk categories respectively. The workstation at spinning and polishing machines are modeled in CATIA and changes in the workstation are demonstrated. The human manikin built around the improved workstation considering the anthropometric dimensions, is analyzed using RULA and it gives a decrease in risk levels from a high risk category (score 7) to low (score 3) at polishing machine and medium risk (score 5) at spinning lathe. Further improvements can be made by application of ergonomic principle to reduce the postural stress and discomfort and increase productivity.

Keywords

RULA, REBA, Musculoskeletal Disorders, CATIA, and Utensil manufacturing.

Biographies



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Veeresh, Kajal, Aishwarya K. and Sampati Bai are students in Industrial & Production Engineering Department, P.D.A.College of Engineering, Kalaburagi. They are student members of IEOM Student Chapter in at PDACE Kalaburagi. Apart from academics they are a part of the research group in Human Factors and Ergonomics Laboratory. They are also actively involved in organizing various events and local industrial visits under IEOM student chapter, and have competed in Best Student Chapter competition at 11th Annual IEOM International Conference at Singapore. 7-11 March 2021, and at 12th Annual IEOM Conference at Istanbul, Turkey March 2022. They have presented a paper at 4th African International Conference on Industrial Engineering and Operations Management, Nsukka, Nigeria, April 5-7, 2022 and were awarded SECOND PLACE under Human Factors and Ergonomics Competition.



Dr. Qutubuddin S.M., working as Associate Professor, Industrial and Production Engineering Department, P.D.A.College of Engineering, Kalaburagi. He has more than 30 years experience in teaching and research and has published more than 40 papers in International and National journals and Conferences. Under his supervision 01 research scholar has completed PhD and 02 are undergoing. His research interest include Human Factors and Ergonomics, Occupational Health and Safety; Production/Operations Management. He has introduced the course Human Factors and Ergonomics in the curriculum in under graduate engineering and has developed laboratories such as Industrial Engineering Laboratory, Human Factors & Ergonomics Laboratory and Quality Control Laboratory. He was actively involved in getting NBA accreditation for the department. He is a life member of ISTE, IPE, IAENG and IEOM Society USA. He has started a student chapter of Industrial Engineering and Operations Management Society (IEOM) Michigan, USA in the institute. The chapter was awarded the best student chapter in the year 2019 at IEOM International conference in Bangkok, and in 2020 at IEOM International conference held at DUBAI and in Istanbul, Turkey 2022. He is serving regularly in various capacities as a Reviewer, Track Chair, Session Chair and Technical Committee member in IEOM International conferences since 2015. He is assigned as Director of IEOM Operations in India. He has been awarded with Best Faculty Advisor Award, Teaching Excellence Award and Distinguished Service Award at IEOM Conferences.