Prevalence of Ergonomic Risk Assessment by REBA and QEC of Working Posture at Small Scale Bakery Industries.

Dr.DeeptiN Wadhwa[1],Dr.Amrit Kaur[2], Mahek Lokwani[3], Gayatri Patil[4]

[1]Associate Professor, MVP's College of Physiotherapy, Nashik, India,[2] Professor, MVP'S College of Physiotherapy, Nashik.
[3]Intern,[4]Intern, MVP'S College of Physiotherapy, Nashik, India.

ABSTRACT

BACKGROUND: *A poor ergonomically and non-scientifically designed work environment and work station may severely affect the labour force's physical stress, labour productivity, and job performance.Musculoskeletal Disorders are described as an injury or dysfunction that commonly involves the supporting structures of the body as well as the nerves, muscles, bones and cartilages.In developing countries, musculoskeletal disorders are of serious concern. Many factors play a significant role in ergonomics, and these factors determine the health, safety, comfort and efficient performance at workplace.In an Indian small scale manufacturing industries most of the work is still carried out standing and manually hence the issues of work related musculoskeletal disorders and injury in various parts of body are prominent.*

MATERIALS AND METHODS: *It was a cross-sectional observational study design. 100 Bakery workers were included in study. The collected data was analysed using frequency and percentage.*

RESULTS:*The result obtained from the REBA and QEC assessment worksheet reveals the different categories of the risk levels. The frequencies and percentages revealed the risk of developing Musculoskeletal Disorders in bakery workers.*

CONCLUSION:*Majority of the bakery workers were found at moderate to high risk of developing Work related Musculoskeletal Disorders and need to take necessary changes soon.*

KEY WORDS- *REBA, QEC, Ergonomics, Work related Musculoskeletal Disorders.*

I.   INTRODUCTION

Ergonomics is the study of the interaction between people and machines and the factors that affect the interaction. Various factors play a significant role in ergonomics, and these factors determine the health, safety, comfort and efficient performance at workplace.[1]In an Indian small scale manufacturing industries most of the work is still carried out standing and manually hence the issues of work related musculoskeletal disorders and injury in various parts of body are prominent.[2] The ergonomics research will help formulate a working concept or a repair system to overcome the problems that arise from the ineffective work posture that has been running.[3]The awkward posture is important among various risk factors.[4] Work related Musculoskeletal Disorders are the occupational diseases which mainly affects the lower back, neck and lower extremities.[5]Many low-investment solutions have been proposed over time to increase labor productivity and yet small-scale technology cannot completely offset the efficiency gap with large-scale industrial operations.[6] Low backache, neck pain and other Musculoskeletal Disorders are the very common.

A poor ergonomically and non-scientifically designed work environment and work station may severely affect the labour force's physical stress, labour productivity, and job performance.[7] Musculoskeletal Disorders are described as an injury or dysfunction that commonly involves the supporting structures of the body as well as the nerves, muscles, bones and cartilages.[8] In developing countries, musculoskeletal disorders are a serious concern. They cause of a third of occupational injuries, leading to decreased worker quality and efficiency and result in substantial social and economic burdens.[9]Productivity is an important aspects of a business, the productivity concept not only implies higher profits, but use their resources efficiently, based on the purpose or goal of the organization.[10]The gap between ergonomic considerations and actual practices at the perspective to design the workstation.[11]

Work related Musculoskeletal Disorders are major problem in almost all countries and are important causes of work incapacity and loss of work days. There have been efforts made in recent years to investigate the causes of musculoskeletal disorders and to take action to prevent them. Rapid Entire Body Assessment was

developed by McAtamney and Corlett. It provides a rapid objective measure of musculoskeletal risk caused by sedentary tasks where upper body demands were high.[12]The other tool is Quick Exposure Check, primarily assesses physical workplace factors, and also evaluates psychosocial factors. Tasks can be normally assessed in 10 mins.[13]

Working in the food industry is a heavy work and its workers may suffer injuries and pains in various parts of the body, generating economic costs in compensation and absenteeism. Some Bakeries may not have safety and health practices in production processes and the large bakery chains have practices governed by the health and safety regulations registered by the Ministry of Labor.[14] Promoting site health and safety is worth paying its financial costs rather than suffering from economical or production losses associated with a lack of health and safety.[15]

II.   MATERIAL AND METHODS

It was a cross-sectional observational study.   100 bakery workers (both male and female) were assessed using REBA (Rapid Entire Body Assessment) and QEC (Quick Exposure Check).   Both male and female workers between age of 18-55 years with atleast one year of working experience and Minimum 8 hours duty and one hour break. Pregnant women, workers with herniated disc, disc infection, any neurological problem and fracture of spine were excluded from the study.

III.   PROCEDURE

After obtaining ethical clearance from the institute, an initial survey wascarried out in the bakeries by visits and discussions with the superior and workers to ascertain the ergonomic deficiencies due to working postures and work environment.Written consents were taken from every single worker. The still photographs of the worker's movements during working were recorded; the snapshots of the workers performing their work were obtained for analysis. At the first stage, working cycle was defined. The Images were investigated further and the various task were analysed. The tasks with higher frequencies were assessed by two mentioned methods. REBA and Quick exposure check. According to the scoring sheets the overall body posture was assessed. The scores helped assess and find out the risk every worker had to develop Work related Musculoskeletal Disorders. The collected data was then analyzed by frequency and percentage. The workers and superior were told few small changes of posture and working platforms that will help reduce their risk further.
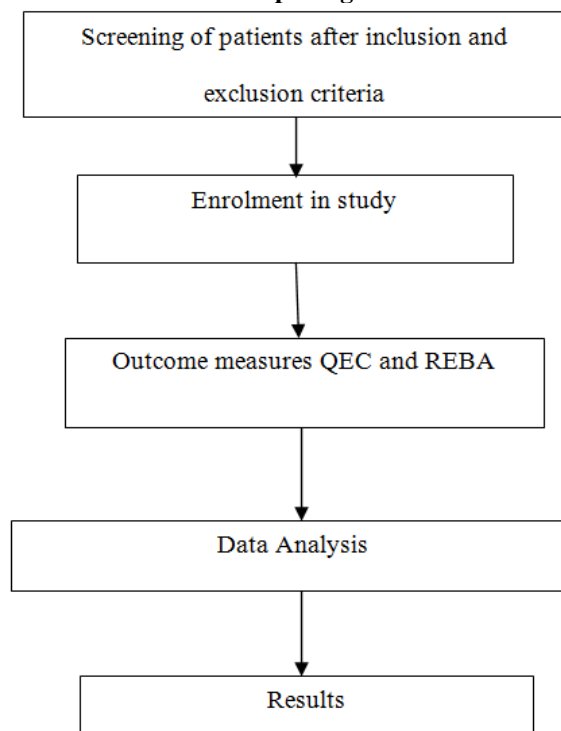
Flowchart Depicting Procedure

Screening of patients after inclusion and exclusion criteria

↓

Enrolment in study

↓

Outcome measures QEC and REBA

↓

Data Analysis

↓

Results

FIGURE 1FIGURE 2

FIGURE 3   **FIGURE 4**

IV.   OUTCOME MEASURES

1.   REBA (Rapid Entire Body Assessment)
2.   QEC (Quick Exposure Check)

REBA-

The body posture is analysed using the REBA method by the articular angles measurements, observing force load and movements' repetitiveness and postural changes' frequency.[27] REBA (Rapid Entire Body Assessment) was developed by McAtamney and Corlett. It provide a rapid objective measure of musculoskeletal risk caused by mainly sedentary tasks. REBA method is a quick and easy to use observational postural analysis tool for whole body activities and giving a musculoskeletal risk action level. REBA is similar to RULA tool where the assessor assigns scores to postures and body alignments based on body part diagram. Load, Force and coupling scores are added to calculation for the body and then final score for both groups are summated to form the final action score. We used several score in this method with the help of REBA score sheet, that the scores evaluate the posture of different body parts Neck, Trunk and Legs give the posture score A with the help of standard Table and Upper Arm, Lower Arm, Wrist twist give the posture score B with the help of standard Table. The loading or coupling scores were added to posture scores A and posture score B to obtain scores A and B, respectively. Combination of scores A and B give Grand score with the use of standard Table and table score C is obtained. After this the activity score is added in the table score C and REBA score is obtained.[12]

REBA SCORE	Risk Level	ACTION LEVEL
1	Negligible	Corrective action including further assessment is not necessary
2 to 3	Low	Corrective action including further assessment may be necessary
4 to 7	Medium	Corrective action including further assessment is necessary
8 to 10	High	Corrective action including further assessment is necessary soon
11 to 15	Very high	Corrective action including further assessment is necessary now

QEC [Quick Exposure Check] –

Quick Exposure Check (QEC) is an observational method that developed firstly by Li and Buckle in 1998 and enhanced by David et al. in 2003.[30]It is observational tool developed for occupational safety and health (OSH) to assess exposure to risk and provide a basis for ergonomic intervention. It has been tested, modified and validated using simulated and workplace task, in two phases of development. The QEC allows main body areas to be assessed and involves workers in assessment. The tool not only focuses primarily on physical workplace factors, but also includes the evaluation of psychosocial factors. Tasks can normally be assessed within 10 mins.[13]This method assesses disturbance in back, shoulder, wrist and neck. QEC helps to prevent WMSDs, such as repetitive action, pressure force, wrong position, and work duration. Basic concept of this method is actually to identify exposure score of certain body parts to others.[30]

SCORE	LOW	MODERATE	HIGH	VERY HIGH
Back (static)	8-15	16-22	23-29	29-40
Back (moving)	10-20	21-30	31-40	41-56
Shoulder/Arm	10-20	21-30	31-40	41-56
Wrist/ hand	10-20	21-30	31-40	41- 56
Neck	4-6	8-10	12-14	16-18

SCORE	LOW	MODERATE	HIGH	VERY HIGH
Back (static)	8-15	16-22	23-29	29-40
Back (moving)	10-20	21-30	31-40	41-56
Shoulder/Arm	10-20	21-30	31-40	41-56
Wrist/ hand	10-20	21-30	31-40	41- 56
Neck	4-6	8-10	12-14	16-18

V.   RESULTS

REBA

5% 0%   16%

19%

■ NEGLIGIBLE
■ LOW
■ MEDIUM
■ HIGH
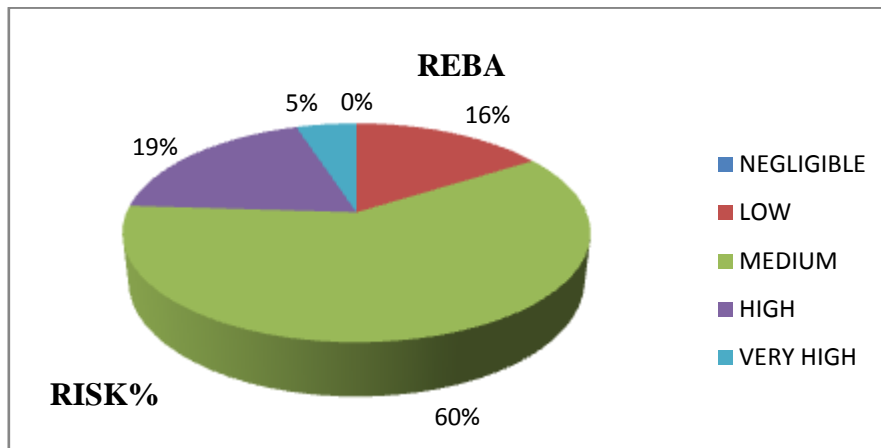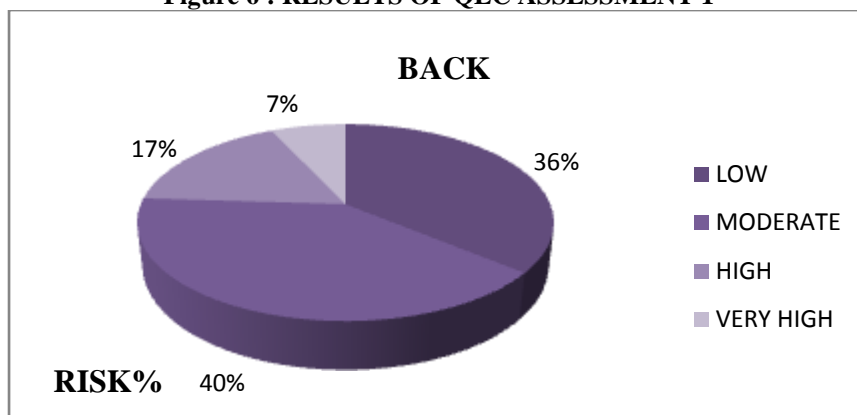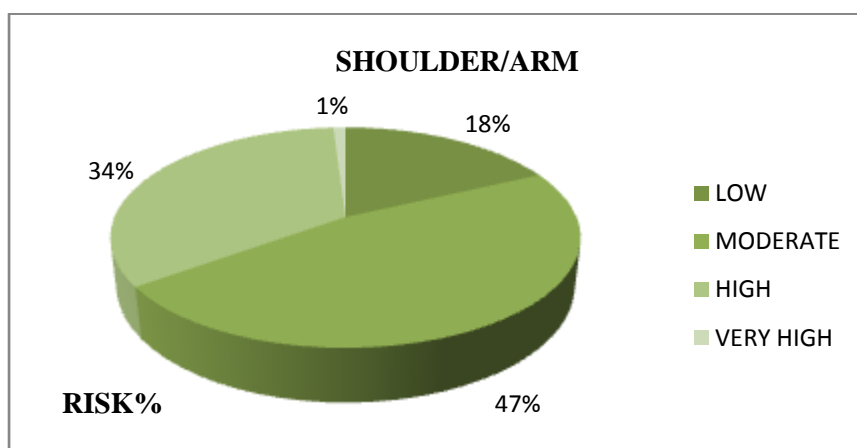■ VERY HIGH

RISK%

60%

Figure 5

The result obtained from the REBA assessment worksheet reveals the different categories of the risk levels. Around 5% of the workers are at very high risk level and needs an urgent change, whereas 19% workers are at high risk levels and needs a necessary action soon. Around 60% of the workers are at medium risk level and needs a necessary change soon whereas 16% of workers may need a necessary change..

Figure 6 : RESULTS OF QEC ASSESSMENT 1

BACK

7%

17%   36%

■ LOW
■ MODERATE
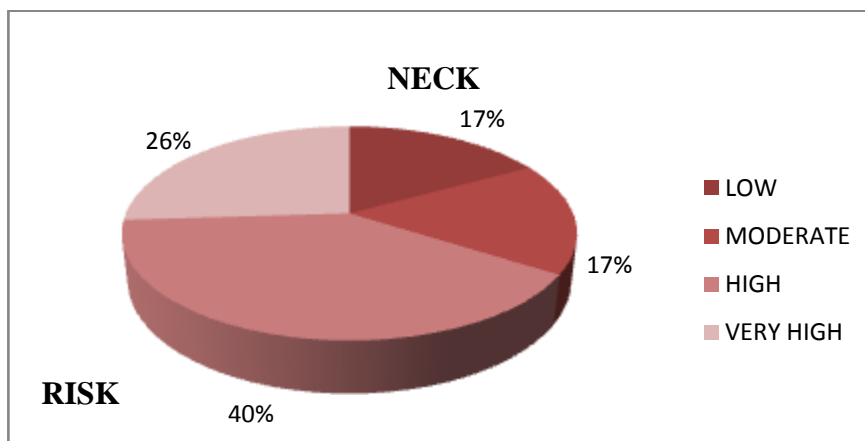■ HIGH
■ VERY HIGH

RISK%   40%

The main findings of QEC show that around 36% workers were at low risk, 40% workers were at moderate risk, 17% workers were at high risk and 7% workers were at very high risk in the back.

SHOULDER/ARM

1%   18%

34%

■ LOW
■ MODERATE
■ HIGH
■ VERY HIGH

RISK%   47%

Around 18% were at low risk , 47% were at moderate risk, 34% were at high risk whereas 1% were at very high risk in the shoulder /arm.
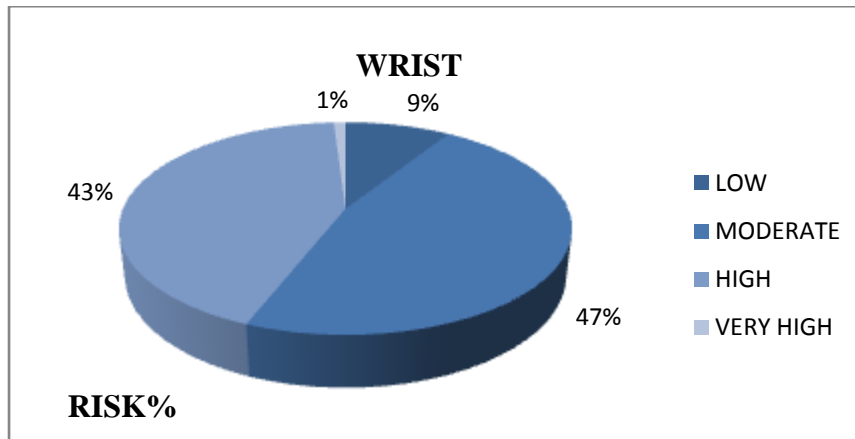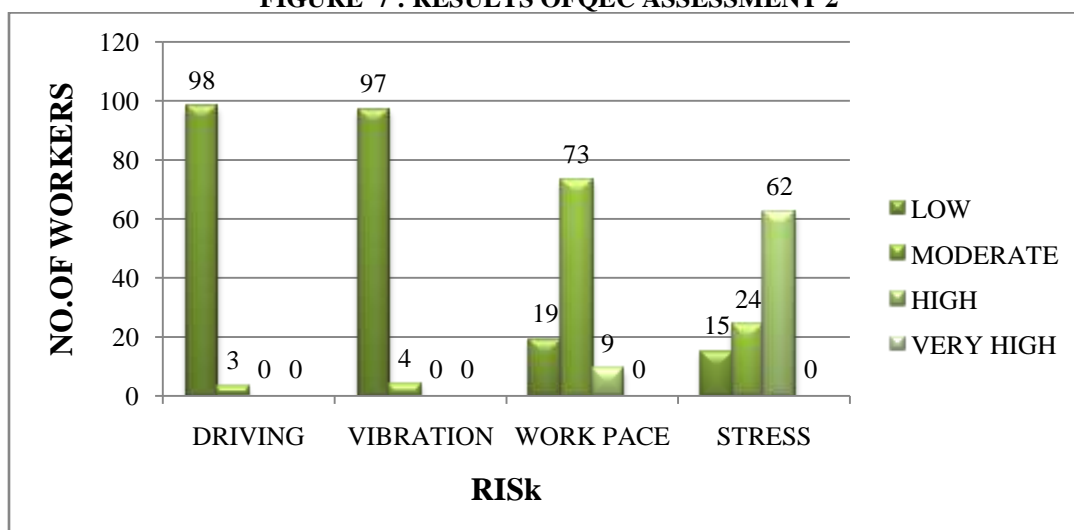
WRIST

Around 9% workers were at low risk, 47% were at moderate risk, 43% were at high risk and 1% were at very high risk in the wrist.

NECK

Around 17% were at low risk, 17% were at moderate risk, 40% were at high risk and 26% were at very high risk in the neck.

FIGURE 7 : RESULTS OFQEC ASSESSMENT 2

In the second part of QEC analysis, we found out that the workers were at low risk due to exposure to Driving to workplace (98% workers) and using Vibrating tools(97% workers) whereas there was moderate risk for keeping up with their work at Bakery(73% workers). 62% workers were at high risk due to the stress at workplace.

VI.   DISCUSSION

In this study, it was found that almost the tasks performed by the Bakery workers were unacceptable ergonomically. Majority of the workers were at Moderate to high risk of developing Work related Musculoskeletal Disorders. It is necessary to take preventive measures to reduce the risk. If the workers kept on working in same unacceptable postures they will suffer from Musculoskeletal Disorders in future. We found out that the bakery workers keep their neck in flexion and also bent their trunk excessively which increased their risk further. All the tools and dough were kept at different places which increased repetitive movements like bending and twisting. The working platforms were either very high or very low. We observed that there was more manual work and very less use of technology even in minor tasks like cutting of dough. This study brought some ergonomically wrong postures, methods and working patterns into picture. The increased risk indicated that there was an immediate need to bring necessary changes.

The workers were recommended some postural and workstation modifications as follows:

•   Redesigning of working posts in various bakery tasks is recommended so that workers can perform their activities without any additional movement and danger, and with ease.[32]

•   There should be rotation of tasks between the workers so that the involved muscles get adequate rest and return to normal. Doing the same task for a long duration of time everyday can increase the risk of involved joints and muscles to develop musculoskeletal disorders and injuries.

•   Try to replace manual work with technological advances. This will help reduce repetitive movements. Replacing manual work with technology will also help reduce errors help in improving precision and reduce muscle fatigue and overuse.

•   The workers were recommended to keep their tools and dough within their reach so that excessive bending and twisting is avoided. Keeping things reach envelope is the best way to save time.

•   The workers should sit while performing different tasks like arranging the tray, cleaning the surface, waiting for another batch to be heated in the oven.

•   The working platforms should be at proper height if it is too high workers were recommended to use stools. Working at proper height is very important to reduce risk of injuries.

The combination these risk assessment and necessary changes will help to create a healthy working environment.

VII.   CONCLUSION

Through the REBA and QEC assessment the ergonomic risk due to working postures of bakery workers was assessed. By implementation of ergonomic principles, bringing about some necessary changes in postures the workers can definitely avoid Work related Musculoskeletal Disorders to some extent.

LIMITATIONS
•   No correlation and comparison was done.

SUGGESTIONS
•   Workers with same years of experience can be considered for the study.
•   Workers with equal working hours can be considered for the study.

CONFLICT OF INTEREST: None.

REFERENCES

[1].   Jagdish R, Asif Ansari, Sameer Quaraishi et al. Ergonomic risk assessment of working postures in small scale industriesGrenze International journal of Engineering and Technology. 2018;(1):202-203

[2].   N.AAnsari and M.J.Sheikh Evaluation of posture by REBA and RULA at small scale manufacturing industry International Organization of Scientific Research Journal of Mech. Engineering 2014; (69): 18-23

[3].   Javier E.Ahfriliandre, IrzaPratama, IsyaNafia et al. The Work posture analysis of packaging workers at PT.X using the REBA method Turkish journal of Physiotherapy and Rehabilitation 2021;32(3): 6260-6261

[4].   Mohammad Khandan, ShahramVosoughi Ergonomis assessment if posture risk factors among Iranian workers Iranian Rehabilitation Journal 2018;16(1): 12-13

[5].   MohommadDidarHossain, AfzalAftab Prevalence of work related musculoskeletal disorders and ergonomic risk assessment among readymade garment workers of Bangladesh;PublicLibraryOf Science ONE 2018;13(7): 3-5

[6].   Raffaelespinelli, GivanniAminti Postural risk assessment of small scale debarkers for wooden post production; Forests 2018; (9) : 1-12.

[7].   Dr.Nilesh D. Dond, Dr. Deepak AnapPrevalence of work related musculoskeletal disorders in small scale industrial workers VIMS Journal of Physical Therapy 2020 2(2): 102-118

[8].   BijalJignesh Karelia, DeepaliRathod Assessment of posture related musculoskeletal risk levels in restaurant chefs using Rapid Entire Body Assessment REBA ,International Journal Of Health Sciences and Research 2021; 11(5): 333-339

[9]. Amir HosseinDavoudianTalab, GholamrezaAzari,Gholamreza Badfar et al. Evaluation and correlation of the Rapid Upper Limb Assessment and Rapid Office Strain Assessment Methods For predicting the risk of musculoskeletal disorders , Internal Medicine And Medical Investigation Journal2017; 2(4): 155-160

[10]. RavindraKene, G.R Naik Applications of ergonomic analysis tools in an industry: A review ; International Research Journal of Engineering and Technology 2019 6(6): 1-5

[11]. D.N Agarwal et al. Study and validation of body postures of workers working in small scale industry through RULA International Journal of Environmental Science and Technology 2011; 3(10): 7732-7733

[12]. Er. Girish Joshi and HarvinderLal REBA Technique on small scale casting industry ,International Journal on Emerging Technologies 2014; 5(2): 61-63

[13]. Geoffrey David, Valerie Woods et al. The development of QEC for assessing exposure to risk factors for work related musculoskeletal disorders; ApplErgon2008;39 (1)

[14]. Esteba Carrera A, OswaldoJara et al. A Look At the Ergonomic Situation of The Bakery Industry In The City Of Quito,Pablo Davila 2019; (1): 1-12

[15]. RomualdRwamamara, Peter Simonsson Self-Compacting Concrete use for Construction Work Environment sustainability , Journal of Civil Engineering and Management 2015;18(5): 724-734

[16]. KianSek Tee, Eugene Low, HashimSaim et al. A study on the Ergnomic Assessment in the Workplace 2017

[17]. Xinming Li, Mustafa Gul, Mohamed Al-Hussein An improved physical demand analysis framework based on ergonomic risk assessment tools for the manufacturing industry, International Journal of Industrial Ergonomics 70; (2019): 58-69

[18]. PinkySaikia and Ruplekha Borah; Postural analysis of women workers in Bakery industry using RULA method; Advance Research Journal of Social Sciences 2018;9(1)

[19]. WorawanPoochada, SunisaChaiklieng Ergonomic risk assessment among cell center workers, ELSEVIER, Procedia Manufacturing 2015; 3(1): 4613-4620

[20]. Kim Sarah Blume, FabianHolzgreve et al. Ergonomic Risk assessment of Dental students RULA applied to objective Kinematic Data ;International Journal of Environmental Research and Public Health 2021; 18(1):1-16

[21]. Khandan M, Eyni Z, Manesh L, Khosravi Z et al. A relationship between musculoskeletal disorders and job performance among nurses and nursing aides in main educational hospital in QoMprovince ,Research Journal of Medical Sciences2016;10(4):307-312

[22]. SaeidYazdanirad, Amir HosseinKhoshkhlagh Comparing the Effectiveness of the Three Ergonomic Ergonomic Risk Assessment Methods- RULA, LUBA, and NERPA- To predict the Upper Extremity Musculoskeletal Disorders. Indian Journal Of Occupational and Environmental Medicine 2018 ;22(1): 17-21

[23]. Baba Md Deros, Dian Darina Indah Daruis A Study on Ergonomic Awareness among workers Performing Manual Material Handling Activities, ELSEVIER Procedia- Social and Behavioral Sciences 2015; 19(5): 1666-1673

[24]. Taylor and Francis; The Ergonomics Kit for General Industry, Second Edition.2006

[25]. Sandeshadhikari August 2018 Ergonomics and its 10 Principles

[26]. https://ergoweb.com/10-principles-of-cognitive-design/

[27]. Majid Motamedzade(PhD), Mohammad Reza. Comparison of Ergonomic Risk Assessment Outputs from Rapid Entire Body Assessment and Quick Exposure Check in Engine Oil Company, Journal of Research in Health Sciences 2011; 11(1) : 26-32

[28]. Kiansektee , I. SaimHashim et al. Study on the ergonomic assessment in the workplace; American Institute of Physics 2017:1-11

[29]. Dima Al Madani and AwwadDabanbneh, Rapid Entire Body Assessment : A Literature Review, AmericanJournal of Engineering and Applied Sciences 2016; 9(1): 107-118

[30]. J.RAyuBIdiawati, Eva Suryani Improving the Work Position of Worker's Based on Quick Exposure Check Method to Reduce the Risk of Work Related Musculoskeletal Disorders; Industrial Engineering and Service Science 2015;(4):496-503

[31]. NehaLodha and Prof.RadhaKashyap Study of Body Postures using REBA in apparel manufacturing industries , International Journal of Multidisciplinary Education Research 2016; 5 (16) : 39-44

[32]. Beheshti Evaluating the potential risk of musculoskeletal disorders among bakers according to LUBA and ACGIH-HAL indices, Journal Of Occupational Health and Epidemiology 2015;3(2): 72-80