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Ergonomic Hazards Associated with Brick Making in a Tropical Wetland: The Case of Sironga Wetland, Kenya

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Abstract:
Brick production processes involve a lot of manual handling which may lead to several ergonomic hazards. This is due to the nature of the work forcing them to bend or carry loads including frequency, time and weight of the load carried at a time. This study was done with the aim of identifying the ergonomic hazards in the brick making industry and the results compared with the local and international standards on load carrying. Different roles were played in brick production by both men and women. Females were mostly involved in carrying bricks on the head while males were involved in mixing and moulding of clay. However, both male and female workers required exerting force. Results revealed that workers were carrying loads more than 25kg against NOISH (National Institute of Occupational Safety and Health) and (International Labour Organization) ILO which stipulates the maximum weight to be lifted, carried on head or shoulders, pulled or pushed is 25 kg for men and 20 kg for women. Heavy load carrying exposes them to several ergonomic hazards such as musculoskeletal discomfort (MSD) and disability. The study recommends ergonomic intervention

Keywords: *Ergonomic hazards, musculoskeletal disorders*

1. Introduction

Work designs is the major contribution of static postures that may result in developmental problems of shoulder and upper limbs (Buckle and Stubbs, 1990). This could be due to the nature of their work that does not allow employees to rest (Kandoko, 2017). The nature of the job determines the workers mechanical exposure profile (Allread*et al.,* 2000). The type of work processes and types of tools may pose a hazard to employees. This is supported by Putz-Anderson (1988) who reported that ergonomic problems can be caused by production demand and fault work methods. Brick production processes involve a lot of manual handling which may lead to several ergonomic hazards. This is due to the nature of the work forcing them to bend or carry loads including frequency, time and weight of the load carried at a time. Heavy load carrying has been associated with musculoskeletal discomfort (MSD) and disability (Kadota*et al.,* 2020). Bao*et al.,* (1997) highlighted that a production system with less production workers results in high body movements. This shows that respondents are working in one position for longer periods. One cause of musculoskeletal discomfort is heavy loading carrying, a common practise in developing countries (Kadota*et al.,* 2020). According to (Samuels, 2005), workers in manufacturing industries are often exposed to ergonomic hazards. This is because tasks in brick making involve a range of physical action from positions and postures that may not be ideal and this could place workers at risks for accidents and injuries (Manoharan, *et al.,* 2012). Souza *et al.,* (2002), indicates that manufacturing industries occupy the position on the frequency and severity of accidents. The nature of manufacturing processes presents ergonomic challenges (Smallwood, 2004). Manual handling therefore may expose workers to different ergonomic hazards.

Carrying loads on a regular basis causes health problems such as musculoskeletal discomfort and disability (Kadota*et al.,* 2020). According to (Fabiano, *et al.,* 2004, Cunningham *et al.,* 2012 and Sinclair, *et al.,* 2013), workers in small business enterprises are exposed more to higher health and safety risks than workers of bigger enterprises. Further, (Abdalla*et al.,* 2017), indicates that OSH laws and regulatory agencies are mostly designed for large enterprises in the formal economy and do not cover the small enterprises or informal economy; therefore, minimal reporting on the informal sector or little enforcement of laws and regulations. Since employees in small enterprises outnumber those in larger enterprises, it is important to address these gaps.

2. Methods

2.1. Study Area and Design

The study was conducted in Sironga wetland, Western Kenya. A multi-stage sampling was used. . Purposive non-probability sampling was employed. The target population in the study area consisted of brick kiln owners and brick kiln

employees. A sample of 233 respondents were randomly selected. Simple random sampling was used to select the respondents to be interviewed. Purposive sampling for focus group discussion was used. Respondent's consent was sought before interviews were conducted to enable the attainment of the objective of this study. Other than the questionnaires and interview schedules, data was also captured through observation using an observation list. Data was collected during working hours between 9 a.m. to 6p.m.

3. Results and Discussion

Brick kiln workers are mostly labour force who are periodic and protecting their health at the work site may not be always on priority of the employer (Vaidya *et al.,* 2015). Different roles were played in brick production by both men and women. A question on whether brick making has any health effects, 71.4 % of the respondents said they had no effect while 28.6% indicted they had some effect (Figure 1).

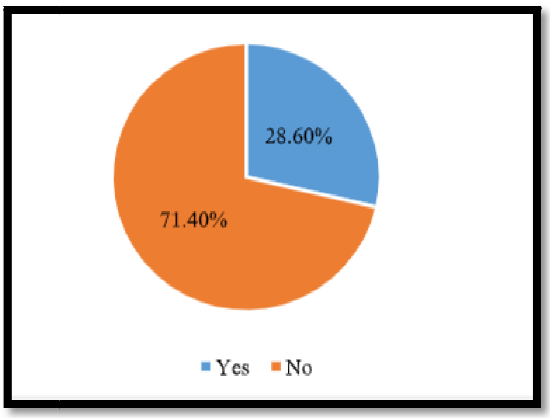

Figure 1: Effects of Brick Making on the Health of Sironga Wetland Respondents

The process of making bricks is done manually and given the nature of the work most musculoskeletal disorders were reported. Most people in the brick industry are employed on contract basis and are used specifically for labour intensive work such as brick moulding using hands, mud-pugging by foot, monitoring and regulating fire in kilns and loading of bricks on the head (World Bank, 2011). According to (OSH) musculoskeletal injuries include injuries to all parts of the body such as the back, neck, upper and lower limbs whether caused by manual handling or not. It can be noted that most of the hazards are associated with manual handling of loads. It is a low technology enterprise requiring manual labour (Nakamya, 2008). Figure 2 shows the different ergonomic hazards on respondents during brick production.

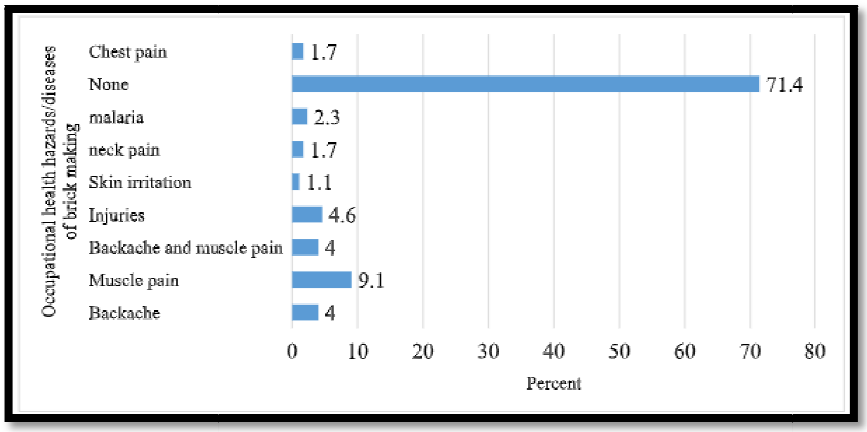

Figure 2: The Ergonomic Hazards Experienced by Sironga Wetland Respondents during Brick Making

The research findings indicate that for the last 12 months, 9.1% of the respondents had suffered from muscle pain 4.6 % from injuries, 4% backache and muscle pain, 1.7 % both chest pain and neck pain and 1.1 % skin irritation. While men and women play different roles in brick making, results show that respondents are either lifting, bending or overloading themselves leading to varying occupational hazards. For instance backache, muscle pain, chest pain in men can be attributed to the fact that digging and extraction of clay, mixing, moulding of clay and transporting bricks to the kilns involves bending and lifting. The minimum number of clay moulded per day was 300 and 700 was the maximum (Figure 3). Study done in Kajjansi, Uganda by Nakamya (2008), indicated back pain, chest pain and malaria as the effects of brick making on human health. The study also found out that malaria resulted from the stagnant water in the open pits. Saha*et al.,* (2021), results on health hazards on people working in brick making activities in Bangladesh showed that respondents suffered from asthma, fatigue, headache and eye irritation.

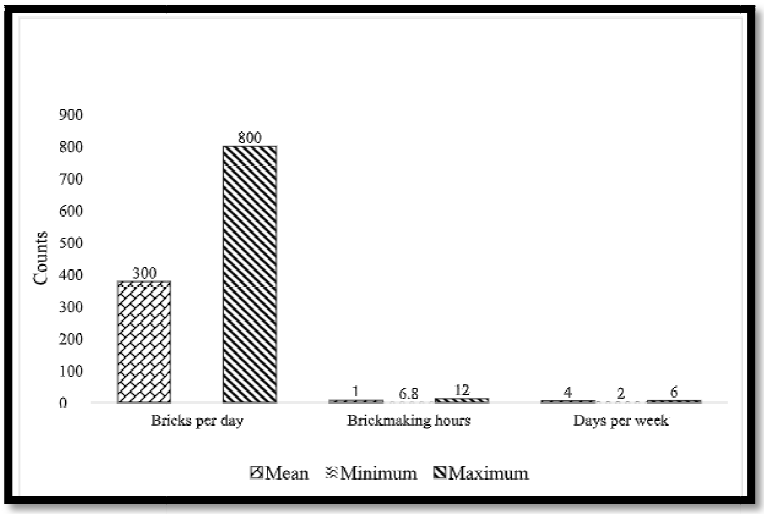

Figure 3: Summary of the Minimum, Maximum and Mean of the Number of Bricks Made Per Day, Number of Hours Spent in Brick Production and Number of Days Spent in a Week for Brick Production in Sironga Wetland

Other than backache and muscle pain, women may experience neck pain due to carrying bricks on their heads. The maximum number of bricks carried per trip on the head was 15 while minimum was 11 bricks (Plate 4.8). The minimum number of bricks carried per day was 300 while 500 as maximum. A similar observation is made in India where women transport bricks on head load where 9 to 12 bricks are carried at a time as head load (Vaidya, 2015). According to (OSH), manual lifting tasks with high loads or frequencies may induce musculoskeletal disorders such as back pain. Though (ILO) has no exact weight limit that is safe, ISO-standard Ergonomics- Manual handling on lifting and carrying proposes a limit of 25kg for men and 15kg for women. Kandoko, (2017) indicates that brick making involves either pushing, pulling of lifting more than 25kg. This suggests that respondents are carrying more than 25 kg which is against ILO and the National Institute for Occupational Safety and Health (NOISH) regulations. According to (Kandoko, 2017), carrying more than 25 kg by employees is due to the need of meeting their targets that may be unrealistic to meet forcing them to overload themselves. The Maximum Weight Convention, 1967 on labour standards in Thailand, Article 7 on female and young workers, stipulates the maximum weight to be lifted, carried on head or shoulders, pulled or pushed is 20 kg for young female employees between the ages of 15 and 18 years and 25 kg for adult female workers. Further, France has restrictions on weights to be handled by younger workers where it allows a maximum of 8 Kgs for a young woman of 14 to 15 years. A report on children working in brick kiln factories, children working in these fields miss their education damaging their futures prospects at the same time damaging their health. In India, The child Labour Regulations and Prohibition Act 2000 strictly prohibits employment of children below 16 years of age working in brick production. It also strictly prohibits children who are under 14 years, but under 16 years, working more than 6 hours a day and 36 hours a week. In South Asia, the Child Labour (Prohibition and Regulation) Act, 1976 prohibits child labour below 14 years. Since respondents were being paid for the number of bricks carried, it results to a tendency of overloading and working for longer hours. This is supported by Kandoko (2017), who highlights that due to the work load, it forces employees to carry more bricks at the same time so as to cover daily work targets. For all respondents, the minimum number of hours spent in a day was one hour while the maximum was 12 hours with a mean of 6.8 hours (Figure 3). The minimum working days was four while the maximum 6 days. Vaidya, (2015) in her studies suggests that carrying head loads on a regular basis causes health problems more especially in women. Studies conducted in India by (Sett and Sahu, 2008) shows that workers in brick making industries suffer from varying health problems caused by poor working conditions and lifting or carrying of heavy loads since it involves brick setting, brick packing and brick dispatching. The Bihar Labour regulations, the Factories Act, 1948 (applicable to brick making enterprises) of South Asia stipulates a mandatory application of a maximum of 8 hour-work day with a one day off. It cannot be ignored that field survey established child labour involved in both brickmaking and transportation though (ILO) prohibits manual load handling by those under 16 years. Prior studies show children accompanying their parents to the work place. It also reports on long working days and child labour. Since the bricks are carried on the head by women and children for longer hours, this can lead to health problems such as spinal problems. This applies too for men who also spend more hours making bricks. Protective clothing among respondents was uncommon since it wasn't applicable with the kind of activity in the wetland. For instance, mixing of mud and water was done with bare feet while loading of bricks done by bare hands. Even if they had gloves, respondents would feel uncomfortable using them. All respondents preferred using bare hands. However, it was observed that most respondents especially men had cracked hand palms and the soles of their feet due to the constant contact of water and mud. Treating of clay is mostly done by foot while moulding of the bricks is done by hands. Similar situations are observed in Nepal, Zimbabwe, South Asia, Ethiopia, India among other countries where the process of brick making involves treating clay by foot and moulding bricks by hand (Maithel, 2012). In this study, ergonomic hazards have been associated with musculoskeletal symptoms. This is probably due to the repetitive motion which is a risk factor for

cumulative stress disorders and repetitive strain injuries (Oyewole, 2014). Therefore, the high incidence of repetitive motions in this study among brick workers are at high risk of suffering these disorders.

4. Conclusion and Recommendation

This study established occurrence of ergonomic hazards among brick workers in the study area. It is necessary for brick workers to take mitigation measures to rectify the situation.

5. References

i. Abdalla, A., Spenser, S. A., Linda, F. C. and Mark, R. C. (2017). Occupation and Risk Injuries. A book on Injury Prevention and Environmental Health (3rded). International Bank for Reconstruction and Development-The World Bank
ii. Allread, W.G., Marras. W.S., and Burr, D.L (2000). Measuring trunk motions in industry: variability due to fask Factors, individual differences and the amount of data collected Ergonomics, **43**(6): 691-701
iii. Bao, S., Winkel, J., Mathiassen, S.E and Shahnavaz, H. (1997). Interactive Effect of Ergonomics and Production Engineering on Shoulder-Neck Exposure-A Case Study of Assembly Work in China and Sweden. International Journal of Industrial Ergonomics **20**:75-85
iv. Buckle, P. W., and Stubbs, D. A. (1990). Epidemiological Aspects of Musculoskeletal Disorders of the Shoulder and Upper Limbs. Contemporary Ergonomics. London, UK: Taylor & Francis 75-80
v. Cunningham, R. N., Simpson, C. D., Keifer, M. C, (2012). Hazards faced by Informal Recyclers in the squatter communites of Asuncion, Paraguay. International Journal of Occupational and Environmental Health, **18**(3): 181-187
vi. Cunningham, R. N., Simpson, C. D., Keifer, M. C, (2012). Hazards faced by Informal Recyclers in the squatter communites of Asuncion, Paraguay. International Journal of Occupational and Environmental Health, **18**(3): 181-187
vii. Fabiano, B., Curro, F., Pastorino, R, (2004). A study of the relationship between occupational injuries and firm size type in the Italian Industry. Safety Science, **42**(7):587-600.
viii. Kadota, J.L., McCoy, S.I., Bates, N.M., Mnyippembe, A., Njau, P.F., Prata, N and Adamson H.C (2020). The impact of heavy load Carrying on Musculoskeletal Pain and Disability among Women in Shinyanga Region, Tanzania. Annals of Global Health, 2020; **86**(1): 17, 1-13. DOI: https//doi.org/105334/aogh.2470
ix. Maithel, S., Vasudevan, N., Johri, R., and Kumar, A. (2002). Pollution Reduction and Waste Minimization in Brick Making. Tata Research Institute, Habitat Place, Lodhi Road, New Delhi
x. Manoharan, P. K., Jha, S. K., and Singh, B. K. (2012). Modelling the risk factors in ergonomic processes in Brick kilns workers using Fuzzy Logic. International Journal of Apllied Science and Engineering Research, **1**(1):92-97.
xi. Nakamya, M. (2008). Effects of brick making on the environment. A case study of Kajjasi Town, Wakiso District, Central Uganda. Msc. Thesis, Kampala International University.
xii. Oyewole SA. Enhancing ergonomic safety effectiveness of repetitive job activities: prediction of muscle fatigue in dominant and nondominant arms of industrial workers. Human Factors and Ergonomics in Manufacturing & Service Industries 24 (2014): 585-600
xiii. Sett, M., and Sahu, S. (2008). Ergonomics study on female workers in manual manufacturing units in West Bengal, India. Asian-Pacific Newsletter on Occupational Health and Safety, **15**(3):59-60.
xiv. Sinclair, R. C., Cunningham, T. R., Schulte, P. P. (2013). A Model for Occupational Safety and Health Intervention Diffusion to Small Businesses. American Journal of Industrial Medicine 56(12):1442-1451
xv. Smallwood, J. (2004). The Role of Optimum Health and Safety (H&S) in Construction Marketing.
xvi. Vaidya, V. G., Mamulwar, M. S., Ray, S. B., Beena, R., Bhathlawande, P. V.,andUbale, S (2015).Occupational Health Hazards of Women Working in Brick Kiln and Construction Industry. Journal of Krishna Institute of Medical Sciences University, 4(1):45-54