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OCCUPATIONAL STRESS IN BRICK INDUSTRY

WITH SPECIAL REFERENCE TO FEMALE WORKERS

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AND
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PREFACE

Brick industry is an old industry and also considered as one of the industry which adds to the pollution. Karad shows large number of clamp kilns and old manual techniques for brick production which is considered as highly polluting. Workers face many occupational hazards arising from workplace environment and faulty ergonomic practices. High temperature, dusty environment, soot, smoke, particulate matter and harmful gases released from kiln exerts stress on the physiological functioning of workers affecting the normal functions of the body.

The present work aims to study the workplace environment and occupational stresses in brick industry. Present research work also studies the effect of work place environment and occupational stress on physiological profile of female workers of brick industry.

The book contains collective information about workplace environment and health hazards of workers exposed in brick industry environment. This information will be helpful to society, educators, researchers and work study experts as well as the workers to incorporate changes in the work pattern and manufacturing techniques and reduce the occupational hazards and improve the health status of workers in brick industry.

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BRICK INDUSTRY

As population of India is growing the demand of basic needs is increasing. India has been slowly progressing from under developed to developed and presently to developed country. Construction industry has taken a speed to meet the demands for shelter of people and simultaneously the demand for raw material for construction has also increased. Rise in demand of bricks has given many people means of earning through brick manufacturing but at the same time workers are under continuous pressure of work to meet these demands which affect their health severely.

The most basic building material for construction of houses is the conventional brick. Bricks are used in construction to make walls, pavement and other masonry work. A brick is made of clay containing soil, sand and lime or concrete material. Bricks are produced in many classes, types, materials and size according to the region and time. Generally fired and non-fired are two main types of bricks. Clay which shows good plasticity is considered for making bricks because it is easy to be moulded. Clay should show the property of getting proper shape after losing water when kept to dry in open environment.

HISTORY OF BRICK INDUSTRY

Burnt clay building brick was invented 5000 years. Many archaeological excavations also showed proofs of bricks used in many part of the world. Clay bricks were manufactured since old times. The use of hand shaped, sundried mud bricks were done during prepottery Neolithic period. Use of mould to shape the clay and firing of bricks started only around 3000 B.C.

Tell Aswad, in upper Tigris region of Southern Turkey showed the use of oldest bricks about 7500B.C. Babylon city showed walls made from burnt bricks in 5^{th} century B.C. The ancient Egyptians used clay bricks dried under solar heat in many historic monuments. During the period of Roman Empire the use of bricks spread to Europe and Italy and in 11^{th} century the use of bricks spread to France.

During 12^{th} century the bricks were introduced in Northern Germany this created brick Gothic period. The buildings were built with fired red clay and buildings in Baltic countries show such bricks. Bricks were used since 1611 in Virginia and for centuries in Mexico, Central America. In Netherland, Belgium and France no real technical progress was made in brick making until World War I.

The ancient Egyptian fortress of Buhen and the Indus valley cities of Mohenjo-Daro, Harappa between 7000 and 6395 B.C also showed evidences of Ceramic or fired brick. Archaeologists discovered Indus valley civilization from old bricks found during the Karachi to Punjab railway track construction. The brick was manufactured by old method in which clay was pressed into rectangular molds by hand called soft mud process.

The onset of Industrial Revolution in England showed massive production of bricks and the increase in factory building. Bright red bricks were chosen for construction in London to make the buildings more visible in heavy fog. The transition from hand moulding to a mechanized form took place during the first half of nineteenth century. The first successful brick making machine capable of producing up to 25,000 bricks daily was made by Henry Clayton from England in 1855.

BRICK INDUSTRY IN INDIA

At the global level Asia is the major producer of brick. It contributes 87% of total brick production in the world. China, India, Nepal, Pakistan, Vietnam, Bangladesh are the major brick producing countries in Asia. Maximum share of 77% is contributed by China and India contributes a share of 15.5%. India stands second in the brick manufacturing sector after China in the world.

Out of the total brick production in India 65% comes from northern gangetic plains. Punjab, Haryana, Uttar Pradesh, Bihar and West Bengal are the major brick producing state in this region. Gujarat, Maharashtra, Orissa, Tamilnadu and Madhya Pradesh are the two main brick producing state in the peninsular plateau and coastal region of India (Gupta and Narayan, 2010).

The brick sector in India is unorganized but tremendous in size and spread. Indian Brick industry shows 60.45% share in the net domestic product of the country and are clearly away from state regulation and protection (Daniel, 2009). Brick industry is continuously expanding because of rapid increase in brick demand in infrastructure and housing industries. The industry has a turnover of more than Rs140 million annually, with an estimated coal consumption of around 25 million tons per year, as the third largest consumer of coal of the country (Gupta and Narayan, 2010). In order to meet increasing demand over 1, 50,000 brick units provide direct employment to more than eight million workers.

It is estimated that there are atleast 1, 00,000 brick field in India and each field is presently manufacturing between 100, 00 and 20 million bricks per year. Out of total brick

production in India 74% comes from bull trench kilns and 21% comes from clamp kilns. Brick industry is small scale industry situated in rural and urban areas and is an important part of rural and urban economy.

Brick industry is old but important industry in India and other developing countries. Brick kilns can be distributed into three categories based on the production capacity (Uma.S, 2000).

Small (up to 1 million brick per year)

Medium (up to 1-2.5 million brick per year)

Large (more than 2.5 million brick per year)

Small kiln is called Clamp kiln and medium and large are called Bulls trench kiln (BTK). The industry uses less technology and bricks are produced by manual method like hand moulding, sun drying and open clamp firing. The industry shows seasonal nature of work; it operates for six to eight dry months of the year. Brick industries are unorganized and rules and regulations are hardly implemented in their industry.

All India Brick and Tile Manufacturers Federation, New Delhi looks after the interest of brick industry on national level. Brick kiln is normally set up on leased out lands near clay source. Simple tools like pickaxe, shovels, baskets, screen, and moulds. the only fixed investment is storage place, pumping of water in brick industry. South India and few places in North show mechanized or semi-mechanized units.

Clay is obtained from silt of rivers and dams or surface soil of barren or hilly lands. Coal, ash, wood shavings, many agricultural wastes are used as fuel in open clamp. Except units in South and North other brick industry employ contract labour for work. Workers are booked by paying advance before season begins.

BRICK INDUSTRY IN MAHARASHTRA

Presently population of Maharashtra is estimated of about ninety two million. Present bricks production in Maharashtra is 11.50 billion yearly. Majority of manufacturers of burnt brick in Maharashtra uses handmoulding, sun drying, and clamp burning method.

Maharashtra has about 11,500 brick manufacturing units. Brick industry is mostly clustered near developed areas like Mumbai, Pune, Nashik, Nagpur, Thane, Solapur, Kolhapur, Sangli, Bhiwandi, Malegoan, Dhule etc. Size of open clamp varies between 25,000 and 10, 00,000.

Western region of Maharashtra is called hub of clamps. Areas showing clamp kilns are districts of Pune, Khopoli, Ahmednagar, Solapur, Satara, Karad, Pimpalwadi and Kolhapur. Perennial rivers flowing through the western Maharashtra region like Krishna, Warana, Koyana and Panchganga bring alluvial soil along with them. This deposited soil is excavated from the banks of these rivers to produce bricks. These parts show small, medium and large scale clamps. Out of total 16-19 tons/100,000 bricks consumption in India, clamp kiln in Maharashtra show 12-15 tons/100,000 bricks coal consumption. soil in Maharashtra shows more plasticity and coal ash is added to reduce it and improve the burnability.

Karad lies in Satara district in the southern part of Maharashtra. It lies at the meeting place of Krishna and Koyana River. Karad is blessed with favourable climate, flowing rivers and rich alluvial soil. The Karad has approximately 300 kilns which operate each season with 50% of them in urban area. The average brick production rate in Karad is 0.6-1.2 million bricks/year per brick kiln and annual brick production is approximately 270 million bricks (Shridhar Kumbhar *et al*., 2014).

BRICK INDUSTRY ENVIRONMENT

Even though brick manufacturing is done since many centuries the fundamental methods of brick making have not much changed. Hand moulding is still practiced in many areas of Maharashtra. A brick manufacturing site shows the storage of coal and other raw material, mixing and moulding section, fired brick kiln, storage of fired bricks and loading and unloading all at one place. There are no separate arrangements for each section.

Workers working in the kiln are provided with house in the manufacturing site itself. Brick manufacturing unit emissions include particulate matter which is released in the working environment by raw material grinding and screening and also from the fired kilns. Combustion products include SO2, NO2, CO and CO2 in brick kiln. Workers working in brick manufacturing unit encounter this particulate matter and harmful gases on daily basis which affects their health badly.

In brick making process sun has its important role so brick making is carried out in open sky under hot sun. The wind blowing in the working area carries the fine dust particles and fine raw material particles and is inhaled by workers and also settles on their body. This release of dust in working area contributes to dusty conditions in and around the brick kiln which cause occupational health hazards and affect the surrounding environment. Working environment of brick industry is very stressful and harmful for the workers.

The government of India issued a notification related to the emission standards for brick kiln in April 1996. Government of Maharashtra has put a ban on operation of all open clamps and moving chimney kilns in the state after 31 December 1997. Maharashtra pollution control board has released a circular to all district collectors to stop issuing brick permission to entrepreneurs not following the brick regulation and guidelines.

BRICK MANUFACTURING

Though brick manufacturing has been practiced since ancient times not much improvement has been seen in the manufacturing process. Use of machines for making bricks is still very less found especially in Maharashtra. Common process performed are excavation of sand, mixing of raw material, preparation of clay, mixing and moulding, sun drying of the bricks, firing of bricks, loading and unloading of bricks.

Skilled labours mostly migrant are hired for the work before the season starts. Soil is excavated from the river banks or barren land. Soil is left for few days in the field in open environment and then screened for stones, gravels and other unwanted materials. After cleaning of sand it is mixed with screened coal powder and baggase. Before screening the coal it is broken down into fine pieces by the workers with a hammer. Preparation of clay is done either manually or using a tractor. Clay is mixed with raw material and pressed manually with feet or with a tractor. After mixing moulding takes place with wooden or metallic hand moulds. Workers put lump of sand in the mould and press it and then unmould it in the place fixed for drying of bricks. Dried bricks are used and kilns are prepared before firing.

In Karad clamps kiln are practiced. Clamps are most polluting and energy intensive. A clamp does not have a permanent kiln structure. It shows a piled layer of green bricks with combustible material spread over it. Clamp is laid with fired bricks on which fuel is spread and green bricks are stacked. The base of pile show tunnels to feed firewoods. Fuel is also added in space provided in brick stacking. Wood chips, rice husk, coal, kerosene, diesel, cloth are used for firing of bricks.

During burning the hot air from the base travels up through the bricks and heat bricks. Smoke and fumes leaves from top of clamp. After 10-11 days when the bricks are cooled down in kiln it is loaded to vehicle and transported to required site. Use of moulding machine has been commercial success in South India, especially in Kerala. Open clamp mostly remain unnoticed and do not come in official record of regulatory agencies.

According to Pollution Control Board, Maharashtra guidelines clamps with batch size >50,000 bricks have to adhere to notification for brick kilns and National Ambient Air Quality Standards whereas batch size <50,000 bricks need to comply only with (NAAQS). Clamps are seen operating near to agricultural field or road while some are very near to residential areas.

Entrepreneur hesitate to shift to new technology due to lack of clarity of different technology, lack of finance, irregular availability of raw material, leashed land for small duration and no incentive from government.

BRICK INDUSTRY WORKERS

The brick kilns provides source of livelihood for unskilled laborers from across the country. Workers of brick industry include men, women and children. According to all India Brick Kiln Manufacturer's Association its membership extend up to 22,000 units with about 3 million workers.

Workers are hired before the season starts by paying an advance of 20 to 25 thousand for the whole family. Entire family of four to five members including husband, wife and children together perform moulding or loading job. Brick kiln labours are paid on the basis of amount of work and after completion of certain target such as moulding or loading of 1000 bricks etc. They don't receive money for the non working day. So though the workers are tired they work in stressed conditions to achieve their target and increase their income.

Workers have no fixed working hours and lunch time in brick industry. Workers show poor economic background and are mostly illiterate. Most of the workers are migrant and come from areas like Karnataka, Beed district due to drought or other natural calamities in their areas. women worker condition is worse because they show large family size and she has to look after her family and also do the brick work

Study of census (2011) showed that out of the total working population in unorganized sector atleast 120 million is women. (Vaidya, Mamulwar *et al*., 2015). Female workers are seen working as molder and loader in brick industry. Brick industry shows many occupational stresses which are harmful to the health of workers. Brick kiln labour is periodic labour force and protection of their health at working site may not be on priority of the employer. Health of brick industry workers often remain neglected making them more disinterested and weak. Environmental factors, ergonomical factors and occupational factors put physical, mental stress on the workers affecting their health very badly.

BRICK INDUSTRY AND OCCUPATIONAL HAZARDS

Hazard is defined as any kind of damage, harm and adverse effect on health. Most of the workers spend their life span in their occupation. Work place environment should provide healthy life to workers. Occupational health is defined by the International Labour Organization (ILO) and World Health Organization (WHO), as "the promotion and maintenance of highest degree of physical, mental and social well being of workers in all occupation." Occupational health hazards can be of following types,

1) Physical hazards

2) Chemical hazards

3) Biological hazards

4) Psychological hazards

5) Ergonomic hazards

I) Physical hazards

Type: - Noise, vibrations, temperature, cold, radiations, illumination, mechanical factors etc.

Health effects:- Hypertension, hyperacidity, palpitation, acidity, weakness, Hand arm vibration syndrome (HAVS), body pain, headache, fatigue, backache, pain in limbs and arms, heat cramps, heat exhaustion, heat stroke, rashes, high fever, dizziness, dehydration, cancer, skin aging, injury, cataract, dermatitis etc.

II) Chemical hazards

Chemical hazards can be explained by three points, inhalation, ingestion and skin contact.

Types: - 1) Inorganic dust like carbon silica, particulate matter, asbestos, iron particles in dust.

Health effects: - Pneumonia, bronchitis, occupational asthma, silicosis, anthracosis, asbestosis, siderosis etc.

2) Organic dust like cane fiber, cotton dust, tobacco dust, hay and grain dust.

Health effects: - breathlessness, cough, emphysema, bronchitis, heart attack, mouth cancer, lung cancer, lung problems etc.

3) Metal and their compound: - Various metal industries like alloy making, extraction, purification, ayurvedic medicine preparation, electroplating industries cause various hazards among workers.

Type: - Lead, mercury, cadmium, manganese, chromium, nickel etc.

Health effects:- Abdominal pain, nausea, teeth and gum damage, anemia, headache, skin rashes, vomiting, pulmonary edema, psychosis, encephalitis, skin eruptions on face and eyelids etc.

4) Acids, alkali and pesticides

Source: - Acids, alkali and pesticide manufacturing chemical factories.

Health effects: - skin infection, gastrointestinal tract disorder, problems related to central nervous system.

5) Solvents like CS_2, C_6H_6, trichlorodhylene and $CHCl_3$

Health effects: - Lung defect, gastro intestinal problems, central nervous system disorders, malignancies leading to death etc.

III) Biological hazards

Type: - Virus, bacteria, fungus, parasites etc.

Health effects: - Brucellosis, leptospirosis, anthrax, hydatidosis, psittacosis, tetanus, encephalitis, fungal infection etc.

IV) Psychological hazards

Psychological hazards arise when demand of workers are not fulfilled and exceeds working capacity. Lack of co-ordination and cooperation causes psychological pressure. Workers mind does not match the working environment. Due to low economic status, illiteracy, debt, alcohol addiction psychological burden arises.

Health effects: - Addiction, reduced work performance, anxiety, insecurity, heart diseases, fatigue, body pain, rapid aging, aggression, impatience etc.

V) Ergonomic hazards

Goal of ergonomic is to reduce hardship of workers and increase work performance. Ergonomically sound occupation reduces musculo skeletal disorders of workers like injuries, muscle pain, muscle fatigue, effect on ligament, spinal disc, nerve etc.

Health effects: - Joint pain, tingling, numbness, shoulder pain, cervical pain, wrist pain, pain in lower part of body, swelling, inflammation, stiffness, neck pain etc.

VI) Occupational stress

When need of workers does not match with the requirement of job harmful physical, mental, emotional responses arise creating physical and mental stress.

Health effect:- Headache, sadness, lack of energy, nervousness, anger, sleeplessness, acne, reduced bone density, high or low blood pressure, heart attack, weight loss or gain, nausea, diabetes, constipation, gastric problem, painful periods, impotency, educed immunity etc.

OCCUPATIONAL STRESSES IN BRICK INDUSTRY

Brick manufacturing industry gives employment to large number of people as work force. A wide range of physical activities are involved in brick industry. Workers engaged in brick industry fall victims of different occupational disorders. Workplace for the workers is not proper and working conditions are not comfortable and involves risk factors. Work of brick making does not follow any ergonomical rule for the betterment of health of workers.

Maximum working hours suggested by the Factories act 1948 is eight hours per day but workers are working 10 to 12 hours a day. This put lot of pressure on their body and mind. Workers are not benefitted with any medical facilities or sick leaves. They are victim of headache, joint pain, skin disease, lung disorder, musculoskeletal disorder etc. Female workers are seen working as carrier and moulders in brick manufacturing industry. Physical activities of female workers consist of bending, pushing, pulling, carrying, climbing etc. due to this repetitive action a lot of strain is experienced by the workers.

Ergonomic deals with the control of the hazards between the workers and his workplace environment. Ergonomic is a scientific study which deals with the study of interaction between man and other factors of the work system. It applies principle and methods to the work for well-being of human and overall work performance. The ergonomic hazards is significant in brick workers due to work in the awkward body position/posture, prolonged twisting, awkward lifting posture, sitting work for long period and repetitive work tasks.

Female workers are at a high risk of physical strain that can lead to musculoskeletal pain and disorders. The National Institute of Occupational Safety and Health (NIOSH) reported the average claim for MSD in US is over $18,000 and near about 250 crore of rupees in India (Manoharan, P.K.Singh *et al.,* 2012). Brick field workers are prone to hypertension due to high

demand of physical activity in brick making occupation. Female workers of brick field often complain about the body pain, headache, cervical pain, lower back pain, waist and wrist pain, joint and ligament pain etc. According to International Labour Organization (ILO) 160-270 million workers suffer from occupational disease every year.

Brick workers show poor economic back ground and are illiterate. They do not have proper lunch time so under nourishment is common in brick field workers especially in female because they get less rest than the male workers. Due to less rest and improper food intake and high work load hematological health of female workers gets affected. Female workers become anemic and weak.

Living environment and working environment of the workers are same which put their life in more risk. There are no proper arrangements of drinking water and sanitation facilities for the female workers. Female workers are continuously exposed to sun due to which they suffer from dehydration, heat rashes, urinary infection, anxiety etc. Dehydration and heat are the two main factors which influence the heart rate of female workers (Moumita Sett and Subhashis, 2014).

Among the chemical hazards brick workers are exposed to harmful gases like SO_2, NO_2, CO, CO2 and silica. They are exposed to high amount of dust while breaking of coal manually. Workers also face high concentration of respirable suspended particulate matter (RSPM) generated during laying ash on kiln and blowing of ash stacked in kiln. Respiratory problems caused by particulate matter include wheezing, coughing, sputum production, shortness of breath, chest tightness, chronic bronchitis, pneumonoconiosis, lung cancer etc (Ali Raza and Sajid Naeem, 2014). Products formed by complete and incomplete combustion are genotoxic, cytotoxic, fibrogenic and DNA damaging (R. Kaushik, F. Khaliq *et al.*, 2012).

Safety equipments like gloves, footwear, earplug, goggles, and protective clothes are very less practiced by workers. Female workers complained about the respiratory problems, gastro intestinal problems, eye irritation, dehydration, skin problems, urine irritation, appetite problems, reproductive problems and musculo skeletal pains. The workers encounter harmful gases and dust which affect their immune system making them more vulnerable to diseases.

The workshop on 23-25 Feb 1998 on women's occupational and reproductive health was carried out by Tata Institute of Social Sciences, Mumbai and organized by Centre for Health Studies TISS, Mumbai and International Labor Organization, New Delhi, May 1999. According to the report of the workshop on sharing the experiences and critical issues of female workers in

different sectors in Maharashtra, women worker of construction industry complained about severe back pain, reproductive problems, skin diseases, itching, irritation, lung diseases etc. Women workers also work for 12-14 hours without any rest giving rise to many health impairments. Women especially carry heavy loads due to which they suffer from body pain and several reproductive disorders.

Brick making industry environment is extremely adverse and not designed properly according to rules and regulation of ergonomics. Since very little study on females of brick industry has been done it is essential to study the occupational and environmental hazards in brick industry and its impact on female workers.

SURVEY OF LITERATURE

Brick manufacturing technique has not much changed and the residues of the unit are harmful to the workers health and human settlements nearby. Among small scale industries, brick industry is developing due to increase in urbanization and the demand of building material was reported by (Bhanarkar *et al*., 2002). It was reported by (Bradsher and Barboza, 2006) that about 160 Kg coal is required for firing 100 bricks. Study of manufacturing of bricks in the past, present and in future was done by (Alaa Shakir and Ali Mohammed, 2013). The study said that conventional method of brick making is still practiced except in south were mechanized technique are used.

Study of the social and economic status of women workers of brick industry in West Bengal by (Swapan Kumar Roy, 2012) stated that women workers belong to low economic class and majority of workers demand was for wage hike as their earning is not sufficient to feed the members of their families. (Palwasha Rabial *et al*., 2013) reported that the reasons for the poverty of workers are debt due to borrowing, illiteracy and migrant life. Workers receive no medical facilities and amenities. Money is borrowed from the owner for medical emergency and it is deducted from the wages of workers.

Rabin Das, (2015) said that female workers are exploited, deprived and do not get the status which the male workers get at the brick industry workplace. (Ajit Shewale *et al*., 2013), studied nutritional and morbidity profile of kiln workers of Thane district and showed child labour, illiteracy, low income among the workers and confirmed the high malnutrition and poor health profile of the workers of brick kiln. (Chafikhur Rahman and Rumani Islam, 2014) studied the role of female labour in brick industry and said that they play very important role by increasing the man power and reducing transportation cost of the owners.

OCCUPATIONAL STRESS IN BRICK INDUSTRY

WITH SPECIAL REFERENCE TO FEMALE WORKERS

Dr. Irumjahan Nazir Khan is currently working as an Assistant Professor at Department of Zoology, Sadguru Gadage Maharaj College, Karad (M.S.) India. She completed her graduation in 2006 and post graduation in 2013. She was awarded by Ph. D. in 2019 by Shivaji University, Kolhapur. She was honored by Late Dr. Appasaheb Tansen Varute Memorial and Late Shivajirao Mulik Smruti Prize by the University for securing top rank in M. Sc. She was DST Inspire Fellow during Ph. D. She has published six research papers and presented papers in more than ten international and national conferences.

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