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RESEARCH ARTICLE

Work related Injuries and Musculoskeletal Disorders among Child Workers in the Brick Kilns of Khejuri of Purba Medinipur in West Bengal

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Abstract

Brick industry in India is the second largest brick producer in the world after China. The industry is one of the largest employment generating industries employing millions of people. Brick kiln workers always remain under heavy work pressure to work more efficiently for higher production during seasons with fewer resources and management skills. This stressful situation becomes worse by **physical discomfords** in the workplace. Brick manufacturing is a labor intensive informal industry using **child workers** as the major work force in India. Workers are required to use physical strength, carry heavy loads and remain in a squatted posture for longer periods doing repetitive tasks posing threats to musculoskeletal system. This study involved cross sectional study of children aged 17 years and below. The study respondent included 301 cases in Khejuri blocks under Purba Medinipur district of West Bengal. Lack of adequate **physical infrastructures**, poor working conditions with nonexistent safety procedures have posed risk to physical, mental and overall well being of children. The study identifies work related physical ailments and discomfords dominate brick industries of Khejuri. The **musculoskeletal disorder** related pain and discomfort was experienced by 73 per cent of working children in this region. This study finds that presence of poorer physical environment, working conditions and practices has contributed to musculoskeletal injuries and problems exposing working children to risks and hazards.

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I. Introduction

Brick manufacturing is a labor intensive informal industry of India employing children as major workforce. This unorganized sector is growing multifold due to ever increasing demands of brick for continued urbanization and rural expansions with techno-modern concretization. Despite of engagement of large population in brick industries data on number of employed workers, accidents, health and safety issues are missing. Brick making is a painstaking labor job often performed by families accompanied by children living in temporary settlements. The brick making mostly involves repetitive works including soil excavation and kneading, molding and staking, drying and transport of green and dry bricks. Previous studies have identified causal relationship between highly repetitive work and neck and neck/shoulder musculoskeletal disorders. The repetitive works involving continuous arm or hand movements affects neck/shoulder musculature and generate loads on the neck/shoulder area. The seasonal brick work starting from September/October usually ends before arrival of the monsoons (June-July). Conditions are fair enough to work outside until the mid of February while later months are treacherous with scorching heat.

The brick making process takes place in dry conditions with exposure to clay dust, sand, and fumes from machines and smoke from furnace. The exposure to dust occurs during excavation of soil, molding of clay and

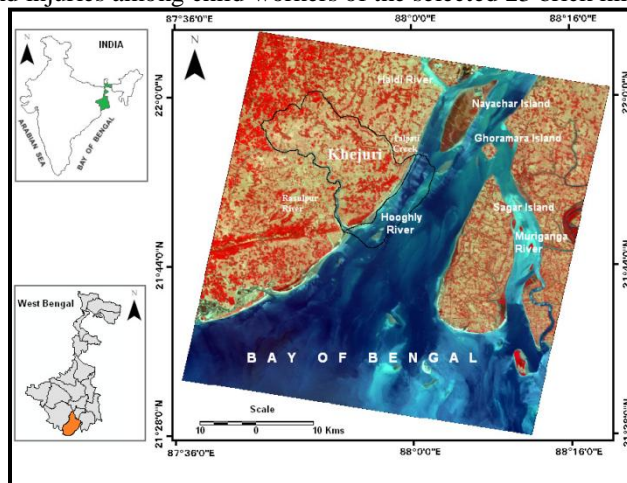
transportation of baked bricks. Fine carbon particulate matter is also released during coal crushing process used for fuelling furnace. The dust and suspended particles blown by air also includes as source of dust. The height of chimney however bars dispersion of smoke at ground level, but fine soot and other particulate matter gets dispersed in the vicinity. The wind at times also carries smoke from adjacent kilns exposing worker with smoke and soot particles.

The brick kilns may emit fine dust particles, hydrocarbons, Sulphur Dioxide (SO₂), Oxides of Nitrogen (NO_x), Fluoride compounds, Carbon Monoxide (CO) and some amount of carcinogenic dioxins if rubber tyres were used as fuel. Published studies demonstrate that inhalation of these matters could affect lung function and lead to increased cardiovascular and respiratory diseases. High level of carbon monoxide produced in brick kilns due to poor design could also increase incidence of heart disease. Previous studies have found the evidence of increase in rate of bronchitis, asthma, impaired lung function, pharyngitis, cough, eye irritation, fibrosis, emphysema, allergic rhinitis, low birth weight associated with deteriorating ambient air quality.

In addition to above mentioned health effects, musculoskeletal outcomes are also of concern in our context. Brick manufacturing is a labor intensive industry requiring muscular energy at most of its production stages. Workers are required to carry heavy loads, well above recommended limit and remain in squatted posture for long periods doing repetitive tasks posing threats to musculoskeletal system. The risks to children are more hazardous due to their growing bodies and weaker systems compared to the adults. Work related musculoskeletal disorders (WMSDs) are common in workers in brick manufacturing industries involved in sorting and stacking processes. They not only cause human injuries and suffering but also involve economic cost reducing working capacity and lesser production. The processes in brick kilns involve interaction of various factors; personal factors include fatigue, fitness, age, and experience of the workers while circumstantial factors involve work schedule and work load and lastly psychological support among workers contributes to affect work and working life.

A recent report on hazardous work in brick kiln industries identified ergonomics as an occupational safety and health issue. The report stated that the main risk factors involve unorganized work procedures, equipment, and workstation design leading to incorrect body posture that can affect joints and muscles. Repetitive tasks requiring frequent bending or twisting of the wrists, knees, hips, or shoulders may impose increased stress on the joints. Very few studies have been published on musculoskeletal problems and ergonomics in the workers in brick kilns and among child workers. A cross-sectional study conducted by Manoharan et al. among 264 brick kiln workers in India revealed that workers suffered from multiple musculoskeletal problems that impaired their daily lives. A study in India examined brick loads and work-related health effects among teenage girls working in brick kilns and reported 86 percent of participants suffered from work-related pain in different body parts, and the main risk factors identified were awkward position at work. Long term exposure to awkward postures further increases risks of injury. Absence of personal protective equipment makes workers more vulnerable also to injury associated with material handling.

This study shades lights on safety and health issues and ergonomics in the selected brick kilns of Khejuri in Bengal focusing more on child workers. The objective of this part of the study was to study prevalence of musculoskeletal disorders and injuries among child workers of the selected 23 brick kilns in this area.



(Satellite/Sensor:-Landsat -5,TM, Date:-February 6,2010, No. Of Bands:-7, Spatial Resolution:-30m, Path/Row:-139/45)

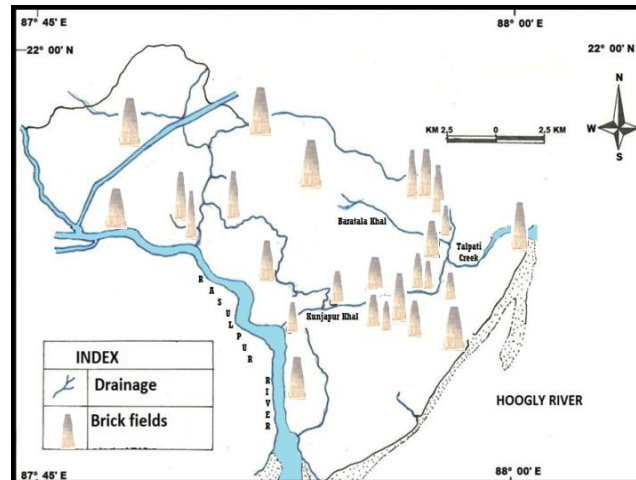


Figure-1 & 2: Location Map of the Study Area & Distribution of Brick Fields

II. Objectives:-

The main objective of the study is to determine hazards, risk reduction measures, and health impacts of child labour in the brick industry in order to guide both national policy & local action in the study area and also Bengal as well as India. Specifically the objectives of study are:

- 📖 To know the working environment of the brick kiln
- 📖 To identify the hazards & risk associated with each of the task
- 📖 To measure the health and nutritional status of the child workers.
- 📖 Subjective analysis of prevalence of self reported pain/ discomfort among brick field workers.
- 📖 Identify the most affected body regions.
- 📖 Impact of pain on productivity.
- 📖 Impact of pain on functioning of body parts.
- 📖 Suggestive measures to improve work environment

III. Methods:-

- 🌐 This is a cross sectional study. Both qualitative and quantitative methods have been used to conduct the study. Quantitative methods (sample survey) have been used to know the hazards and health impacts experienced by the children working in brick kilns of Khejuri CD Blocks of West Bengal and qualitative methods (observation) have been used to measure the nature of the working environment and health hazards.
- 🌐 Girls and boys (11-17 years) who worked at least 2 years in the brick kilns were the basic criteria for sample selection. Using purposive sampling; verifying their age, period of work involvement and upholding the study purposes a total of 301 samples have been selected; individual child workers are the unit of analysis in the sample. The respondents totaled 301 working children. Twenty three brick kilns were treated as a single unit for the observational risk assessment component to know about the overall working environment and health hazards encountered by the child worker.
- 🌐 Separate structured questionnaires for the child workers, Focus Group Discussion (FGD) and Observation Checklist were used to collect the data. The clinical data were collected (spirometry, hemoglobin, weight, height and temperature test) and recorded both digitally and manually.
- 🌐 Standardized Nordic questionnaires for the analysis of musculoskeletal symptoms and questions on injuries were administered for collecting primary quantitative data on musculoskeletal disorders. Data collection for the study has been conducted throughout 3 successive years, 2012, 2013 and 2014.
- 🌐 Face to face interviews, using a pre-tested structured questionnaire, test), was used for collection of quantitative data. The individual child was interviewed for the respective parts of the questionnaire. In cases where the child lives alone at the workplace or had migrated with relatives then the adult parts of the questionnaire were filled up by the child's close adult workers. Separate structured questionnaires were used for the child workers. Observation method has been used to know the overall activities according to the age group and sex of the working child in the brick kiln and to measure the hazards associated with the work.

- ☉ Data has been entered and cross-checked using Epi-info version 3.5.1 and analysis is performed using SPSS version 20.0 for this study. Frequency table, percentages and contingency tables, different diagrams has been used for descriptive analysis. The formula of incidence rate is used to measure the incidence of various health hazards.

IV. Results and Analysis:-

Table-1: Age at Start to Work for Money

Age at Start to Work for Money	Male		Female		Total	
	Frequency	%	Frequency	%	Frequency	%
6-8	20	10.1	5	4.9	25	8.3
9-11	28	14.1	9	8.7	37	12.3
12-14	49	24.7	28	27.2	77	25.6
15-17	101	51.0	61	59.2	162	53.8
Total	198	65.8	103	34.2	301	100

Due to lack of proper monitoring, brickfields have sprung up like mushrooms and the situation has created a serious threat to environment and biodiversity while the people in the neighboring areas face health hazards and fertility of farms is going down. Villagers living near the brickfields, especially children and elderly people are often affected with various diseases including bronchitis and asthma due to environmental pollution.

☉ Recent health events

All most half (77.7 per cent) of the child workers experience fatigue or exhaustion. This clearly demonstrates that the work is tiring for the child workers. A higher percentage of child workers (54.1 per cent) have sometimes experienced minor cuts or bruises. However the percentages of child that often experienced minor cuts or bruises is low (15.3 per cent for child worker) but not negligible. About two-third of child (62.8 per cent) sometimes felt pain in their body, whereas around one-fourth of child worker (23.6 per cent) often felt pain in their body during last one month.

Table-2: Recent health events (last 1 month)

Recent health events (last 1 month)	Child Workers				
	Often	Sometimes	Never	Unanswered	Total
Experienced fatigue	32(10.6%)	202(67.1%)	43(14.3%)	24(8%)	301(100%)
Experienced minor cuts	46(15.3%)	163(54.1%)	68(22.6%)	24(8%)	301(100%)
Felt pains in body	71(23.6%)	189(62.8%)	17(5.6%)	24(8%)	301(100%)
Felt anxiety or fear	67(22.3%)	114(37.9%)	96(31.9%)	24(8%)	301(100%)

☉ Injuries during last 1 year

Among the child workers, 85.7 % experienced cuts or bruises, 10.0 per cent experienced sprains, strains or dislocation, 10.0 per cent experienced burns or scalds and 7.1 per cent experienced broken bones during the last year.

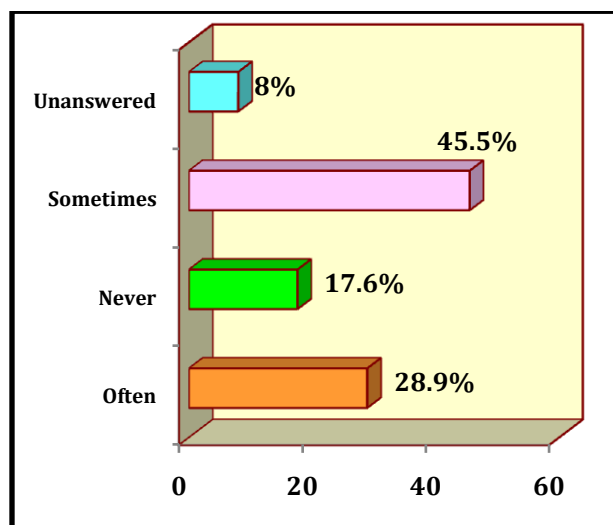


Figure-3: respondents experienced bad cuts

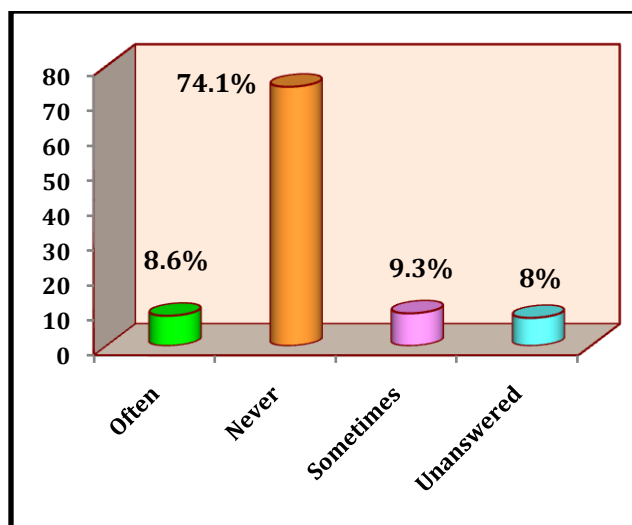


Figure-4: respondents experienced broken bones

Table-3: Distribution of respondents experienced different injuries during last 1-year

Recent health events (last 1 year)	Child Workers				Total
	Often	Sometimes	Never	Unanswered	
Bad cuts or bruises	87(28.9%)	137(45.5%)	53(17.6)	24(8.0%)	301(100%)
Broken bones	26(8.6%)	28(9.3%)	223(74.1%)	24(8.0%)	301(100%)
Sprains, strains, dislocation	9(3%)	21(6.9%)	247(82.1%)	24(8.0%)	301(100%)
Burns or scalds	4(1.3%)	19(6.3%)	254(84.4%)	24(8.0%)	301(100%)

The legs and hands are the part of the body of these child workers which are most likely to be injured.

Table-4: Parts of body that injured during last 1 year

Parts of body that injured (last 1 year)	Child Workers (%)			
	Bad cuts	Broken bones	Sprains, strains, dislocation	Burns or scalds
Legs/foot	72.1	56.9	68.2	49.8
Arms/hands	56	43.7	53.1	52.6
Head	2.5	0	0	19.1
Neck	5.1	0	0	0
Backbone	5.9	1.5	0	0
Abdomen	3.5	10.3	0	0
Shoulder	4.3	2.1	5.6	1.7

Table-5: Body Part Discomfort Scaling (BPD) Scale (n=23)

Body Parts	Body Part Discomfort Scaling						Total		
	Grade-0 (No Pain)	Grade-I (Slight Pain)		Grade-II (Moderate Pain)		Grade-III (Sever Pain)		Number	%
		Number	%	Number	%	Number	%		
Head	19(6.3%)	26	8.6	199	66.1	57	19	301	100
Neck	5(1.7%)	33	10.9	129	42.9	134	44.5	301	100
Shoulders	0	4	1.3	108	35.9	189	62.8	301	100
Elbows	0	22	7.3	82	27.3	197	65.4	301	100
Hands	0	9	3.0	113	37.5	179	59.5	301	100
Wrists	6(2%)	36	12.0	187	62.1	72	23.9	301	100
Upper Back	6(2%)	11	3.7	131	43.5	153	50.8	301	100
Lower Back	4(1.3)	19	6.3	92	30.6	186	61.8	301	100
Hip	0	19	6.3	78	25.9	204	67.8	301	100
Thighs	0	9	3.0	113	37.5	179	59.5	301	100
Knees	0	14	4.6	98	32.6	189	62.8	301	100
Ankles	6(2%)	46	15.3	177	58.8	72	23.9	301	100

Feet	13(4.3%)	32	10.6	189	62.8	67	22.3	301	100
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From the above table, it is seen that in case of most of the body parts like shoulder, elbow, hands, upper back, lower back, hip, thighs and knees, more than 50% of respondents suffers on Grade-III BPD with severe pain whereas head, wrists, ankles and feet are suffered from moderate pain having Grade-II BPD. There are very few of respondents who suffer slight pain or no pain situation on Grade-II and I BPD.

Table-6: Types of work responsible for injury

Types of work responsible	Child Workers (%)			
	Bad cuts or bruises	Broken bones	Sprains, strains, dislocation	Burns or scalds
During carrying red brick	42.3	51.7	53.7	0
While using moulding machine	4.3	2.2	2.8	0
During brick making	6.8	1.8	1.9	13.3
During carrying green brick	30.2	42.5	38.9	0
During cutting firewood	0.9	0	0	0
During carrying firewood	11.7	1.8	2.7	0
During brick burning	3.8	0	0	86.7

Most of the child worker experienced bad cuts (42.3 per cent), broken bones (51.7 per cent) and sprains, strains or dislocations (53.7 per cent) while carrying brick from the kiln to where the fired bricks were stacked outside. A higher percentage of child workers (86.7 per cent) experienced burns while burning green bricks.

© Specific illness during last 1 year

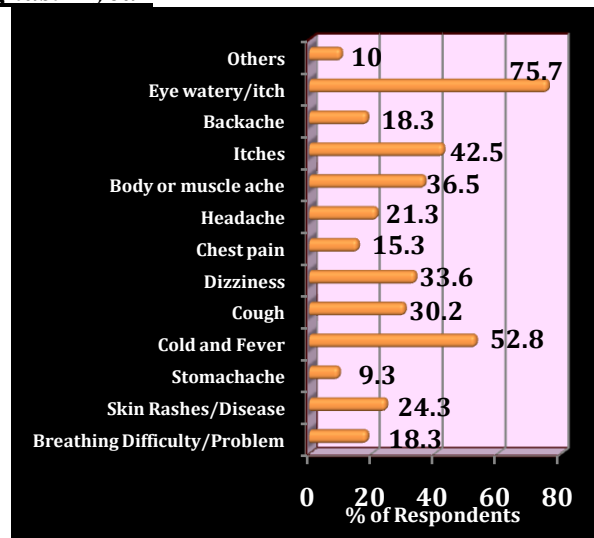
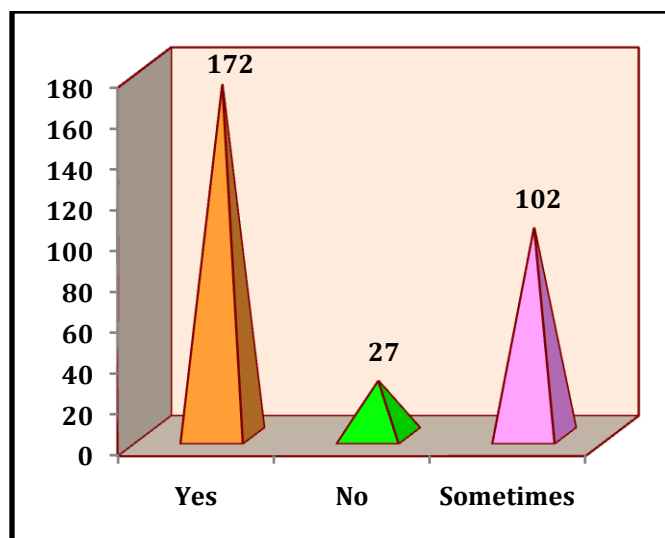


Figure-5: General Health Problems

The study investigated some specific illnesses, namely breathing problem or persistent cough, ear problems, skin problems, and stomach problems or diarrhoea among child workers, youth workers and control group. From the above diagram shows 53% worker suffer from cold and fever & 9% suffer from stomachache.

It is evident from the above table that 57% respondent state that their work is caused for their disease.



&Figure-6:- opinion towards whether their job causes their illness or not.

General health issues

The study shows that, fever is quite common among all respondents of this study. About 79.6 per cent child worker have reported that they have suffered from fever during last one year. However, the incidence of headache is higher among working child (55 per cent). Conversely, feeling weak and bad all over was much more common among child workers (65.9 per cent).

Table-7: Percentage distribution of respondents experienced fever during last one year

respondents experienced fever during last one year	Frequency (%)
Yes	67 (22.3)
No	61 (20.4)
Sometimes	173 (57.3)
Total	301 (100.0)

Table-8: Percentage distribution of respondents experienced headache

respondents experienced headache during last one year	Frequency (%)
Yes	48 (15.7)
No	103 (34.3)
Sometimes	150 (50.0)
Total	301 (100.0)

Table-9: Percentage distribution of respondents felt weak during last one year

respondents during last one felt week year	Frequency	%
Yes	76	25.3
No	103	34.1
Sometimes	122	40.6
Total	301	100.0

Table-10: Hours of sleep at night

Hours of sleep at night	Child worker (%)
Less than 8 hours	19.7
8 hours	26.4
More than 8 hours	53.9
Total	100.0

About half of child worker (53.9 per cent) sleeps more than eight hours at night. However 19.7 per cent child worker sleeps less than eight hours.

Table-11: General health issues among child workers

Other General health issues	Child Workers (%)	
	Yes	No
Have trouble of insomnia	33.7	66.3
Have a nap or rest during the day	56.8	43.2

Feel hungry a lot of time	74.9	25.1
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A total of 33.7 per cent of child workers were suffering from insomnia during last one year. About 56.8 per cent child worker have reported that they take rest during the day. More than half of child worker (74.9 per cent) feels hungry a lot of time.

☉ Serious Health Issues

About 15.7 per cent of child workers have had other very bad injuries at work. About one-fifth of child workers (21.4 per cent) know other people of their age who were injured very badly at work. A few respondents (2.3 per cent child worker) know about some people who died because of injuries at the brick kiln. More than 80 per cent of child workers have noticed that young people use tobacco products.

Table-12: Serious health issues

Serious health issues	Child Workers (%)	
	Yes	No
Ever had any other injury that was really, really bad at work	21.4	78.6
Other people of their age have been hurt very badly at work	28.2	71.8
Other persons died because of an injury at the brick kilns	2.3	97.7
Knows that young people use drugs or alcohols	79.0	21.0
knows young people use tobacco products	82.4	17.6
Know young person (< 18) has been sexually/physically abused or had bad things done to them	54.6	45.4

☉ Focal health issues

About 59.1 per cent of child worker have reported pain in neck or back. However among them, 27.6 per cent of child workers have mentioned that the level of pain in the neck or back is very bad.

Table-13: Focal health issues

Focal Health Issues	Child Workers	
	Number	%
Neck or back has been bothering		
Yes	178	59.1
No	123	41.9
Level of pain or bother by back or neck		
Very Bad	83	27.6
Medium	185	61.3
Not Bad	33	11.1
Trouble in breathing or cough a lot		
Yes		43.3
No		56.7
Level of trouble in breathing or cough		
Very Bad	120	39.8
Medium	124	41.2
Not Bad	57	19.0

Troubles in breathing or cough are more prominent among child workers (81 per cent). Among these child workers, 39.8 per cent have reported that the breathing problems or cough are very bad.

☉ Nutritional status and anemia

The study found that about 36.7 per cent of child workers are underweight, only 6.8 per cent have overweight and 56.5 per cent have normal weight.

Table-14: Nutritional status of child workers

Factors	Child Workers (%)
Nutritional status of Youth worker	
Underweight	36.7
Normal weight	56.5
Overweight	6.8
Total	100

V. Discussion

The study showed that musculoskeletal injuries and problems exist as a major threat in the brick industries of Nepal. The association of children in hazardous works in absence of any safe practices and management has increased this risk to manifolds. The comparison of working and non-working children also revealed the vulnerabilities of children exposed to brick manufacturing with prevalent musculoskeletal injuries and problems attributed to work.

The physical factors and external ambient environment for the brick making job were found to be with full of risks. Brick workers, especially molders, were exposed to the heat and natural conditions for longer duration; additionally the workers are also exposed to high concentrations of dust, fumes and particulate. The incidences of Work Related Musculoskeletal Disorders (WMSDs) were quite common in the brick industries. Research in manual brick industries have revealed that longer standing hours, continued deviated wrist positions and forceful exertions has increased risk of work related musculoskeletal disorders which also remains valid for this study. The presence of fall and drowning risks were also high as workers were exposed to conditions with heavy load and unsafe surrounding e.g. with presence of open pits and water holes. Jobs in brick kilns involve a wide range of physical actions demanding different postures and positions which are not often considered to be ideal increasing more risks of accidents and injuries. The common jobs in brick kilns often comprises of pushing, pulling, bending, reaching, stretching, lifting, lowering, sitting, standing, walking and carrying, mining/rimming of clay, preparation of clay, molding of clay, drying of bricks and burning of bricks. Although mechanized process was found to be used in some kilns physical forces dominates this sector with increasing physical discomforts. The prolonged stresses and strains caused during various activities with different load conditions in the brick industries can be the major cause for work related musculoskeletal disorders. Kopf et al. (1988) reported in a similar line to this study finding that with increasing levels of job demands aggravated by heavy physical work, awkward postures, repetitive and continuous movement and restrictive positions attributes to exposure response relationship between sickness and forceful, repetitive work.

The World Health Organization, recognizing the impact of work-related musculoskeletal diseases, has characterized work related musculoskeletal disorder as multi-factorial, indicating that a number of risk factors contribute to and exacerbates these maladies. As evident with study findings based on environmental setting, injury history and work practice various risk factors compounds to musculoskeletal disorders. The common reported disorder related to musculoskeletal involves majorly injury of the soft tissues are referred to by many names, including WMSDs, repetitive strain injuries (RSI), repetitive motion injuries (RMI), and cumulative trauma disorders (CTDs) around the globe. A comprehensive review of epidemiological studies has assessed the risk factors associated and has categorized work related musculoskeletal disorder affecting the body part including (1) neck and neck-shoulder, (2) shoulder, (3) elbow, (4) hand-wrist, and (5) back which are often attributed to task-related risk factors including repetition, force, posture, vibration, temperature extremes, and static posture.

The similar risk factors and resulting body discomfort were also identified in the sampled kilns of Nepal. The postures adopted by the workers depends largely upon nature of work, the design and environment of the work place, personal characteristics of individual worker, the tools used for work and also on the duration and frequency of the work cycle. The posture required for brick making job varies according to the job, letting aside the mechanized process, the manual conditions for soil excavation, kneading and molding process requires constant movement and transfer of heavy loads. The molding job which is considered to be the most difficult job requires remaining in squatted position for longer duration with constant upper limb movement under natural environment exposure. The musculoskeletal disorders were also found to be compounded with lifting of heavy loads. Most of the loads were found to be carried in back or in head with higher chances of injuries to back, neck and shoulders.

The vulnerability of children with exposure to unsafe working conditions and missing ergonomics practices pose considerable risk to their physical well-being. The fragility of children and their susceptibility owing to their tender age makes children more prone to work related problems. This study showed that children responded to multiple pain and injuries owing to working conditions. It has been identified that children are more prone to musculoskeletal disorders and varieties of work related problems including injuries and illness. The little experience at work, developing physique and little awareness on work risks has increased greater chances of illness among children. The associated risk involved for children were identified as heat syndromes; joint and bone deformities; musculoskeletal problems from repetitive motion; blistered hands; bruised feet from dropped bricks; lacerations; breathing difficulties; silicosis and other occupational lung diseases; insect bites; poor nutrition; bacterial and viral diseases; and injury from moving vehicles as the major health impacts from the brick industry which also corroborates with this research findings.

Table-15: Hazards in Work process (Equipment Risk & effect on body)

Steps of Work		Machine /Tools Uses	Hazards & Risks associated
Collection of Clay	Digging out Clay	Excavators, Spade	Cutting of fingers on leg
	Load onto the Car		Back pain, headache
	Transportation	Truck	Falling from the truck
	Unload	Spade	Cutting of fingers on leg, Chance of injured by the spade of others in any part of the body
Preparing Clay	Digging out clay	Spade	Bad cuts & feel pains in hand & neck.
	Hauling clay	Van top (One wheel cart)	Bad cuts, sometimes sprains & broken bones also
	Hauling water to make mud	Through plastic pipe joined in a motor	Bad cuts
	Mixing soil with water	Pug machine	Cutting of fingers, hearing problems
	Kneading clay	Pug machine	Pain in shoulder,
Moulding	Packing clay in mould	Mould made by timber or steel and thin yarn	Minor Cuts.
	Emptying clay from mould	Mould made by timber or steel and thin yarn	Bad cuts, skin problems, eye problems
Drying	Arranging brick to dry	Manually	Minor cuts or skin burns in sun, feeling weak
	Turning bricks as they dry	Manually	Minor Cuts, pain in hand.
	Sprinkling sand over bricks	Manually	Breathing problems, skin problems.
Burning	Transporting bricks to kiln	Mainly by head, sometimes with push cart or pull cart	Bad cuts or bruises, dislocation & Broken bones.
	Placing brick in the kiln	Manually	Falling of brick in body, Breathing problems, skin problems, bad cuts, & sometimes broken bones.
	Taking bricks out of the kiln	Manually by head	Breathing problems, skin problems, bad cuts, & sometimes broken bones.
	Stacking bricks	Manually	Feeling of pains in body, skin & breath problems, week feeling.
Transportation	Lifting bricks onto cart/animal	Manually	Broken bones, Sprains, strains, dislocation
	Herding animals that transport bricks	Manually	feeling weak in body,
	Driving cars to transport the bricks	Motor driven car specially locally made for brick transportation	Any types of accident can occur

The burden of child labor is not a new phenomenon in the study area of Bengal as well as India. Although poverty remains as the major push factor for children to start working in the kilns but lack of awareness and feeble enforcement of legal tools remains major factors contributing children to work at the kilns. Research accords to this study findings that child labor does not replace adult labor, but complements it, similar to this study which identified that children were mostly accompanying their parents to work at the brick kilns.

The optimal use of ergonomics can considerably reduce work related risks and increase overall well-being of productive worker. The primary objective of ergonomics is to minimize the risk of work-related musculoskeletal disorders through planning, designing, assessing and evaluating tasks, jobs, tools and systems. The objectives are achievable but preparedness and commitment is imperative at all levels. This study was based on handful sample nevertheless it portrays an overview of musculoskeletal disorders in the brick kilns focusing on child labors. Future studies are required to explore more on both clinical and non-clinical parameter affecting musculoskeletal problems, furthermore policy analysis endeavors would also help reduce risks and establish safe practices.

VI. Recommendations

The brick kilns need a well designed comprehensive ergonomics plan and the necessary resources to support the same in order to improve the prevention of WRMSD's, health risks of child workers and improve the working conditions and productivity of all of the workers. Some of the improvements may be in the following directions:

- Implement a continuous training programme so that each worker becomes aware of the relevant factors concerning postures/discomfort.
- Improve the workplace and equipment by making minor changes to prevent awkward postures.
- Considering anthropometry to determine minimum and maximum height to avoid bending and twisting.
- Design of trolleys and truck for transportation of bricks and/or raw materials
- Better organize the workplace layout to minimize movements, twisting and asymmetrical lifting or lowering.

- f) Limit the height of brick stacking to avoid movements above the shoulder height
- g) Various guidelines and measures should be formulated to prevent MSD's.
- h) Illiteracy and unawareness emerged as the major constraints regarding workers involvement in different activities and adopting awkward postures.

Hence the role of the owners, developmental organizations, and ergonomists in educating the workers becomes more prominent.

VII. Limitations of the Study

Research is a complex, complicated and scrutinizing activity based on scientific knowledge and competence. For doing the study a lot of problems are suffered by the researcher's. Some of these problems are given below:

- 1) The fieldwork was limited only in Khejuri CD Blocks of Purba Medinipur District of Bengal. The study sample size is very precise.
- 2) Most of the sample respondents are illiterate or less illiterate. So, due to this reason, proper and adequate answer could not be taken from the respondents against questionnaires.
- 3) To prepare an analytical study, financial assistance is most necessary. Lack of sufficient money, various types of analysis did not possible.
- 4) To conduct the field work there has been faced different kinds problems and obstacles from political, administrative and also brick field owner's sites.

VIII. Conclusion

The musculoskeletal disorders and injuries related to brick manufacturing are highly present in the sampled brick industries. The children with exposure to unsafe working conditions were found more vulnerable to injuries. The comparison among working and non-working children also showed ample evidence of musculoskeletal injuries related to works. The ergonomics and safe practices have to be established to reduce work related vulnerabilities and increasing over all wellbeing of workers. Although the concept of safety/ health and good ergonomics practices are still missing in the brick kilns of the awareness of study area on these are absolute for required changes. The major issue of child labor remains a cross cutting issues which requires serious efforts and contribution of all involved. This study has been able to identify that musculoskeletal disorders and injuries remains prevalent in brick kilns of Khejuri and catering physical, organizational and cognitive ergonomics needs will ensure good work practices and better health of workers.

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