Assessment of injuries in small scale sawmill industry of south western Nigeria

Segun R. Bello[1], Yahaya Mijinyawa[2]

(1. *Department of Agricultural Engineering, Federal College of Agriculture, Ishiagu, Ebonyi State, Nigeria*
2. *Department of Agricultural and Environmental Engineering, University of Ibadan, Nigeria*)

Abstract: Body injuries sustained in sawmill industry during the milling activities in Ondo, Oyo and Osun states in the Western part of Nigeria were investigated. Nigeria Sawmill Industries are essentially distributed between small, medium and large scale in the proportion of 81%: 13%: 6% respectively (RMRDC, 2003). A survey involving the use of questionnaire, participatory approaches, on-the-spot assessments and interviews were used as tools for investigation. A total of 140 injury cases were recorded among 64 workers from investigated sawmills. The data collected were subjected to descriptive statistics. Results indicated that mill workers suffers highest injury rate of 83% while moving logs to mill from log yard or stack while timber stacking accident is the least at 36%. Other accident cases recorded during the investigation include; log transport to the mill is 22%, milling operation 41% and maintenance accident 38%. Injuries occurring to body parts include upper limb injuries (Neck and head, arm, wrist, hand and shoulder) 68%, back and lower back injuries 58%, and less prominent lower limb (Legs, knees and ankle) injuries at 13%.

Keywords: hazards, injuries, overexertion, sawmill

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1 Introduction

The major wood processing industries in Nigeria are typically with large capacity having many facilities such as large sawmills, plywood mill, pulp and paper plants and quite large numbers of small scale wood products manufacturing companies such as furniture industries, cabinet makers and carpentry. Round-wood in Nigeria comes mostly from the natural high forest zone of the country, in particular from the Southern States of Cross River, Edo, Delta, Ogun, Ondo, Ekiti, Osun and Oyo States. The most important wood products, produced, consumed and traded in Nigeria are sawn-wood, plywood, particle board, news-print, printing and writing paper and other paper boards (Kraft paper).

The nature of the work while handling the type of equipment and material by workers in these occupations are prone to hazards. These hazards and injuries resulting from such incidence include: being caught-in or struck by machinery, falling from a height, heavy lifting or repetitive movements, twisting or while reaching, and breathing in noxious or toxic chemicals while working for wood processing to increase productivity. Besides the hazards inherent in this profession are the unfavourable weather conditions and noise pollution that is injurious to human health. (Judd et al, 2004). In order to fully assess the safety environment in the mill sites within these areas, an overview of the wood processing industry activities and associated hazards are necessary.

2 Wood processing industry in Nigeria: sawmill sub-sector

Majority of the saw mill industries are located in the wood producing rain forest areas of the country which include western states. The largest concentration of sawmills are in Lagos, Ekiti, Osun Cross River, Ondo, Oyo, Imo, Edo, Delta and Ogun States. Together, they

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Corresponding author's email: segemi2002@yahoo.com

accounted for over 90% of the saw milling activities in the country (RMRDC, 2003). This indicated that guaranteed log supply is a major factor in the location of sawmills in the country.

Hazards/risks in the sawmill industry include: environmental hazards as a result of poor forest management and practices, poor solid waste management and toxic emissions to air, noise pollution, machinery hazards, and ergonomic hazards resulting from lifting of heavy loads, reaching for objects, repetitive work, and unsuitable work posture (Aruofor, 2000). Workers are also prone to injury when removing scrap or finished pieces from the table, known as kickback injuries as a result of incorrect blade height etc. As a result of the high level of human (manual handling) involvements in sawmilling operations, workers are exposed to higher levels of risks associated with log handling and machine operation, environmental hazards, work related body injuries, and in extreme cases, fatal accidents.

Human factors, which acts upon the working capacity and the daily production efficiency, include the individual characteristics such as sex, age, body-size, physical fitness, nutritional and state of health (Aiyelari et al, 1998, Jekayinfa, 2007). It has also been observed that psychological, cultural, economic, technological and organizational factors also act upon man's working capacity and production.

In Nigeria, sawmill size is distributed between small: medium: large scale in the percentile proportion (81%: 13%: 6%) respectively (RMRDC, 2003). As a result of this very high variations, the scope of this study is limited to hazards and safe work attitudes of mill operators of the small scale sawmills which represents the largest portion among the sawmill distribution in Nigeria. The objectives of this paper therefore include: 1) The assessment of the hazards inherent in sawmill industry in Nigeria, 2) Identification of the most prevalent working injuries among sawmills operators in Nigeria and the causes of those injuries, 3) Recommendation on ways of avoiding these identified hazards.

3 Materials and methods

3.1 Study area

The study was conducted in Ondo, Oyo and Osun States in the South Western part of Nigeria. The choice of these states in the south western states of Nigeria stems from the fact that over 80% of the small scale processing industries in these locations deal with milling, re-sawing or furniture making or integrated mill activities.

3.2 Research methodology

The research method for primary data collection for the study include on the spot assessment (Robson, 1993) for physical appraisal of safety environment, structured questionnaire (Busha and Harter, 1980) and participatory approaches (Babbie, 1986). The respondents are made up of mill workers, machine operators, et al. These methods of data collection were used in similar work reported by Aiyelari et al., (1998); Aiyelari et al., (1997); Cole and Ogungbe (1987); and Lehman (1962).

Research methods stated above were used to carry out random sampling of sawmills in the study area. The target population within the study areas are the employees of the sampled sawmills and 64 filled questionnaires was used for data analysis. The collected data were analyzed using descriptive statistics (Gomez and Gomez, 1984) and according to work-related hazards surveys conducted by the National Occupational Health and Safety Commission's (NOHSC, 1998, 1999). The findings of this investigation were shown in percentages, frequencies, tables and charts.

3.3 Classification of data

The data were classified and recorded by categories as follows:

Personal information on worker – Information recorded: age, type of training and years of experience on the job.

Injury occurrence by location –The location is necessary to identify the accidents occurred spots within the mill environment. This information was relevant to determine the accident prone area in the entire mill. Three different locations within which the sawmilling activities were concentrated include: public road to the mill, sawmill yard, and the workshop.

Body area affected by injury –This category identified the specific body part that was injured including: ankle, arm, back, body/multiple, chest, eye, foot, hand, head, leg,

shoulder and other. These were further grouped into three segments as follows; upper limb/arm (including neck and head, arm, wrist, hand and shoulder) segment, back and low back segment and lower limb segments.

4 Results and discussion

4.1 Personal information on the respondents

The demographic data and educational qualification of the respondents are as presented in Table 1. The gender ratio indicated that 70% were male while 30% were female. 52% of the age group falls within 25-44 years old, while 41% were 45 years and above. The level of education of the respondent equally showed those with tertiary education having the lowest with 9%, West Africa School Certificate (WASC) holders were 58% while first school leaving certificate (FSLC) holders were 33%. The occupational structure showed mill worker having the highest population with 31%, and maintenance personnel with the least of 9%.

Table 1 Demographic data of the respondents

Variable	Frequency	Percentage
A. Gender ratio		
Male	45	70.31
Female	19	29.69
Total	64	100.00
B. Age group of the respondent		
15-24	5	7.81
25-34	18	28.13
35-44	15	23.44
⩾45	26	40.63
Total	64	100.00
C. Level of education		
FSLC (Primary)	21	32.81
WASC (Secondary)	37	57.81
Tertiary	6	9.37
None	-	-
Total	64	100.00
D. Occupation		
Log driver	10	15.36
Sawmill sawyer	13	20.31
Waste trimmers	15	23.45
Mill worker	20	31.25
Maintenance personnel	6	9.38
Safety Professionals	-	-
Total	64	100.00

These data suggests that more males (70.31%) were engaged in sawmilling activities thus confirming the FAO report of the female tendency towards rural farming and trading activities (Forestry Statistics, 2003). Information on age groups indicated that age 25-45 group is the highest with 51.57%, implying that those who participated in milling activities are those in active age that can hustle around for the demands of the job. Three identified parameters were used to discuss the safety environment of the mill sites situation which includes: the locations around the mill where accident cases occurred, the operations performed at the time of injury and the part of the body affected.

4.2 Injury occurrence by location

The accident cases occurred at three different locations which represents the total area within which sawmilling activities are concentrated as follows: 52% of the accidents/injuries occurred within the sawmill yards: 38% of the accident cases occurred at sawmill workshops/ production areas and 10% occurred on the public roadways. This result is an indication that most accidents are concentrated within the sawmill yard.

Injury cases reported during mill activities include log transport to the mill (n=14, 21.88%), moving logs to mill for log yard or stack (n=53, 82.81%), injury during milling operation (n=26, 40.63%), maintenance accident (n=37, 37.50%) and moving timber to stack (n=23, 35.94%). The prevalence of injury during log movement and feeding into the machine were found out to be as a result of the manual work done by group of workers while pushing and rolling or lifting of heavy logs who constitute a leverage as alternative for live deck conveyor feeding systems or hydraulic lift use in large scale sawmills.

4.3 Injury to body due to sawmill activities

Number of injury cases on various part of the body while undertaking specific tasks were as indicated in Table 2. Accident cases were recorded during log transportation to mill, log stack, milling, and machinery maintenance and timber movement to timber stack/market. Operations carried out at the time of injury are represented in the vertical columns while the specific body areas affected were represented along the rows in Table 2.

Table 2 Injuries to body area due to sawmill tasks/operations

Body area affected	Log transport	Moving logs to mill	Milling using circular saws	Maintenance	Moving timber to stack	Total injury cases	Body injury among 64 workers/%
Neck and head	2	-	2	1	1	6	9.38
Back and low back	4	13	6	8	6	37	57.81
Abdomen and chest	-	5	1	1	-	7	10.94
Shoulder	1	10	3	-	-	14	21.88
Arm	5	11	6	4	7	33	51.56
Wrist and hand	2	9	8	7	9	35	54.69
Hip/Leg	-	5	-	3	-	8	12.5
Total	14	53	26	24	23	140	
Injury among 64 workers/%	21.88	82.81	40.63	37.50	35.94		

4.4 Body area injury

The body areas mostly subjected to mill site injuries were the back; low back, head, limbs, fingers and toes. The injuries to these body areas as recorded in Table 2 ranges from bruises and sprains to the back and ankles, cuts inflicted by flying wood chips and stone, loss of a finger or some fingers to saw blade and machine parts, arm and leg injuries. Injuries to the back and low backwere frequently high (*n*=37, 57.81%) as a result of bending awkwardly to lift heavy logs, reaching for far objects and working on low log tables leading to loss postures, developing bow-back and lower back disorders. This injury evidently takes a long time to manifest thus interactions with workers with such feasible deformities regarded not as an injury but a natural phenomenon.

Wrist and hand injuries were also prevalent at 15.63% including finger cuts encounter with saw blades; mostly the forefingers, bruises and stiff wrist as a result of overexertion and repetitive motion disorders, arm injuries (*n*=10, 10.96%) including strains developed from lifting heavy lumbers onto the mill table and removal of sawn wood, shoulder injuries at 21.88% has a related effect as the arm injury. Many of these incidents had similar circumstances and commonly associated factors. Regardless of the working category, gender differences or location of the mill in which accidents occur, these circumstances and contributing factors are with emphasis on the type of fatal events, rather than the working category of the affected persons.

For the purpose of comparison of major parts of the body most susceptible to injury cases body area was classified into three major segments as follows: upper limb injuries, back injuries, and lower limb injuries. Upper limb injuries (including neck and head, arm, wrist, hand and shoulder) were more prominent (*n*=95, 67.86%), back and low back injuries (*n*=37, 57.81%), and lower limb injuries were less prominent at (*n*=8, 12.5%). The distribution of injury location between upper limb, back/low back and lower limb were relatively consistent with most industries where manual handling was present, since the upper limb and the trunk are the body areas most commonly involved in these tasks.

The percentage of body stressing injury (36%) due to lifting of lumber, lifting or lowering of sawn lumbers, boards and other heavy machine parts in awkward position were high and accounts for lower back pains often experienced by the workers and a long term effect of work-related-disorders. Being hit by moving or falling objects, being trapped by moving or being trapped between stationary machinery were more critical during maintenance and milling operations (23%).

4.5 Causes of injury

Investigation revealed the respondents notion about the health concept and safety rules for operating in sawmill and do not give preference to basic training in work safety during operations. None of the workers had attended any safety training during ther job period. The knowledge acquired was based on the apprenticeship training and experience gathered on the job. In some cases, many entered the industry as traders but not as a trained wood industry worker with requisite professional knowledge. This has exposed the workers to some untold level of hazards.

The high percentage of body injuries recorded in Table 2 were largely due to manual hauling of heavy log by a number of workers rather than the conventional

conveyors or lift crane. Such occurrences were also attributable to movement of sawn products such as log transport, loading and offloading, lumber stacking and transport to the lumber market, during equipment maintenance including restoration, repair and routine maintenance of mill and saw filling.

4.6 Observations

A major risk factor easily noticeable in most of the mills were the age factor of the machine and equipment in use. Most of the machines were obsolete with most of the safety guards removed or non-functional.

During log loading, a number of workers often constitute themselves to conveyor pushing, rolling or jacking heavy green logs into the saw table. This often led to accumulated stress which causes lower back injuries and other health hazards. On-site observations showed that little attention was paid to the use of individual protection devices such as wearing of earmuff or plug when operating machine, wearing of hand gloves when moving and stacking logs or sawn lumbers, neither any preventive measures were taken to prevent hazards due to chemical emission from some species of log while handling.

The workers acknowledged the possibility of hazards resulting from chemical emissions from exposed surfaces of some wood species and offensive odour from the sawmill wastes whenever it rains. Little attention was paid to the health implications of such emissions (James, 2001), some regarding it as not significant. Other non-visible body effects such as changes in environmental and body temperatures could increase blood pressure and pulse rate of workers as influenced by space heating of heavy duty engines.

On site observation revealed that environmental safety, work place organization and safe work procedures have not been taken as seriously because there were heaps of wood shavings from planning machine and saw dust accumulation around circular saw and band saw (Figure 2). Waste disposal system in the mills obtained from respondents were shown in Table 3.

Table 3 Mill waste disposal methods in the mill site

Waste disposal method	Frequency response	Percentage response
have wood waste dump sites for disposal by burning	10	15.56
heap wastes within the open spaces and burn on daily basis	31	48.45
local food vendors and villagers packed for domestic use	12	18.77
Disposal for agricultural uses and animal bedding	6	9.38
Other means of disposal apart from above	5	7.82
Total	64	100

Figure 1 Identifiable hazards in sawmill sites: 1) Manual Lifting and stacking sawn lumber, 2& 3) Non-use of protective wears and equipment during maintenance, 4 & 5) Repetitive motion, twisting and reaching for objects and 6) Breathing in of noxious or toxic chemical emissions during waste disposal with head pan

Accident investigations and documentation were essentially non-existent as evident by the non-availability of accident/injury records in most of the visited sites. Organizing the effective training for workers particularly young and newly employed should be regularly done to minimize human danger. Non-availability and in many cases disregard to the use of individual protection devices and other safety materials caused was largely responsible for the high rate of musculoskeletal and respiratory infections in the industry.

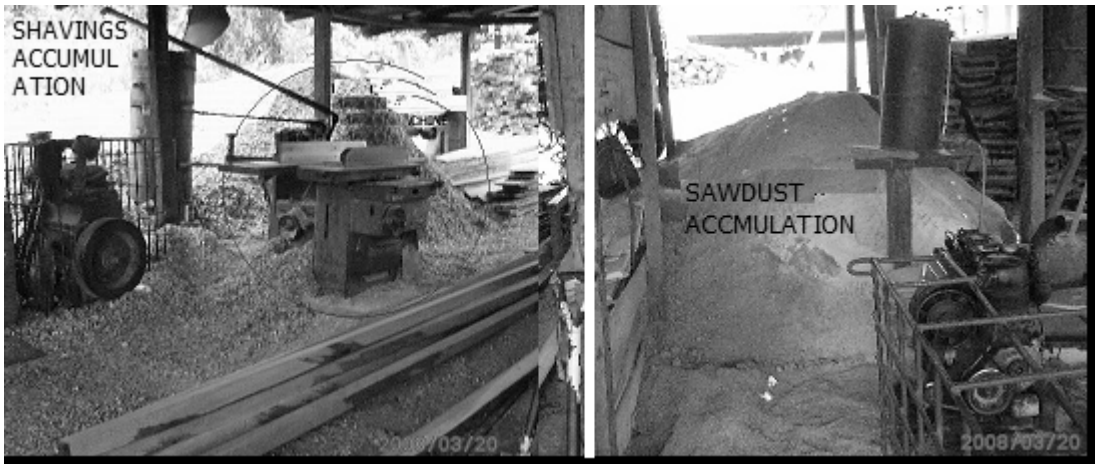

Figure 2 Waste accumulation around the mill (Source: Okigwe sawmill site, 2008)

5 Conclusions

The following conclusions were made based on the investigation conducted in the industry:

1) The categories of workers in sawmill industries acquired their skills and expertise from their practical experience during the job period. However, the professional knowledge regarding safety approach of their work were lacking.

2) Attentions to safe work environment and organization were not adequate. Also the appropriate tools were not available to carry out effective routine maintenance.

3) Most operations carried out in the mills were largely supported by manual handling which often result to overexertion and a long term health hazards.

4) Personal protection devices such as earmuff or plug, hand gloves were not used adequately and were often considered as irrelevant and disturbing.

5) Dust and wood wastes were not properly disposed which was evident from heaps of wood shavings and saw dust accumulation around milling machines.

Finally it was observed that none of the companies had any safety policies, materials, etc. in place, but a reliance on workers responsibility to provide the appropriate personal protection device, to have a safe working environment. Focus should be on these challenges in practical terms to form a safety legislation, comprehensive systems approach and monitoring group in the industry to guide the management in the implementation order to reduce or eliminate workplace hazards.

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