

Assessment of Injuries in Small Scale Sawmill Industry of South Western Nigeria

Segun R. Bello¹, Yahaya Mijinyawa²

¹Department of Agricultural Engineering

Federal College of Agriculture, Ishiagu, Ebonyi State

²Department of Agricultural and Environmental Engineering

University of Ibadan, Nigeria

Corresponding author's email: segemi2002@yahoo.com

ABSTRACT

Body injuries sustained in sawmill industry as a result of mill site activities in Ondo, Oyo and Osun states in the Western part of Nigeria was 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 spread round sawmills investigated. 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 include; log transport to the mill is 22%, milling operation 41% and maintenance accident 38%. Injuries occurring to body area 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.

1.0 INTRODUCTION

The major wood processing industries in Nigeria are typically large capacity facilities industry 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 of Nigeria. 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 done by workers in these occupations and the types of equipment and materials they handle present many on-the-job 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 reaching, and breathing in noxious or toxic chemicals while working for 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.

1.1 Wood Processing Industry in Nigeria: The Sawmill Sub-Sector

Majority of the saw mill industries are located in the wood producing rain forest areas of the Country in which the western states are among. The largest concentration of sawmills are in Lagos, Ekiti, Osun Cross River, Ondo, Oyo, Imo, Edo, Delta and Ogun States. Together, they 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 forestry practices and management, poor solid waste management and toxic emissions to air, noise, hazards due to machinery use, and ergonomic hazards resulting from lifting of heavy loads, reaching for objects, repetitive work, and poor work posture (Aruofor2000). Workers are also prone to injury when removing scrap or finished pieces from the table, 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, death.

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 millers in the largest proportion (small scale sawmills) that represents the sawmill distribution in Nigeria. The objectives of this paper therefore include: (a) The assessment of the hazards inherent in sawmill industry in Nigeria, (b) Identification of the most prevalent sawmilling injuries among sawmills operators in Nigeria and the causes of those injuries, (c) Recommendation of ways of managing of these identified hazards.

2.0 MATERIALS AND METHODS

2.1 The 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.

2.2 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, 1975). The respondents are made up of mill workers, machine operators, etc. These methods of data collection were used in similar reported work of 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 some sawmills in the study area. The target population within the study area is the employees of the sampled

sawmills; 64 returned questionnaires was used for data analysis. The collected data was 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). To achieve this, percentages, frequencies, tables and chart was employed.

2.3 Classification of Data

The data were classified and recorded by categories as follows:

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

Injury Occurrence by Location –The location is necessary to know the location within the mill environment where cases of accidents occurred. This information was relevant to determining which part of the entire mill area is accident most prevalent. 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.

3.0 RESULTS AND DISCUSSION

3.1 Personal Information on the Respondents

The demographic data and educational qualification of the respondents are as represented 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%.

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.

3.2 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.

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

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 was found out to be as a result of the manual (a form of communal efforts of many workers) pushing and rolling or lifting of heavy logs by a team of workers who constitute a leverage as alternative for live deck conveyor feeding systems or hydraulic lift use in large scale sawmills.

3.3 Injury to Body Due to Sawmill Activities

Number of injury cases on various part of the body while undertaking specific tasks is 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 is represented along the rows in Table 2.

Segun R. Bello and Yahaya Mijinyawa. "Assessment of Injuries in Small Scale Sawmill Industry of South Western Nigeria". *Agricultural Engineering International: the CIGR Journal of Scientific Research and Development*. Manuscript 1558. Vol. XII, March, 2010.

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		

3.4 Body Area Injury

The body areas mostly subjected to mill site injuries are the back; low back, head, limbs, fingers and toes. The injury to these body area 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 back are all the time 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 it 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 they 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) is more prominent (n=95, 67.86%), back and low back injuries (n=37, 57.81%), and lower limb injuries is less prominent at (n=8, 12.5%). The distribution of injury location between upper limb, back/low back and lower limb is relatively consistent with most

industries where manual handling is 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 is 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 is more critical during maintenance and milling operations (23%).

3.5 Causes of Injury

Investigation revealed the respondents notion about the concept health and safety rules for operating in sawmill and do not give preference to basic training in safe-work operations. None of the workers had at any time attended any safety training in the number of years they have put into the job. The knowledge acquired is based on the apprenticeship training and experience gathered on the job. In some cases, many entered the industry as traders and 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 tables 2 was largely due to manual hauling of heavy log by a number of workers rather than the conventional conveyors or lift crane. Such occurrences are 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.

3.6 Observations

A major risk factor easily noticeable in most of the mills is the age factor of the machine and equipment in use. Most of the machines are 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 is any preventive measure paid to hazards due to chemical emission from some species of log handled by putting on overall.

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 (Huff, 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 planing machine and saw dust accumulation around circular saw and band saw (figure 2). Waste disposal system in the mills obtained from respondent is shown in Table 3.



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 are essentially non-existent as evident by the non-availability of accident/injury records in nearly all the sites visited. Organization of 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)

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 bases	31	48.45
local food vendors and villagers pack 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

4. 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 on the job and years of experience put into the job. However, they lack the professional safety approach to their work.
2. Attentions to safe work environment and organization are not adequate. Also the right tools are not available to carry out effective routine maintenance.
3. Most operations carried out in the mills are 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 are not used adequately and are often considered as irrelevant and disturbing.
5. Dust and wood wastes are not properly disposed; this 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 work 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.

5.0 REFERENCES

- Aiyelari, E.A., Cole, A.H. and Alabadan, B.A. 1997. An evaluation of human energy requirements in gari production in Ibadan, South-western Nigeria. *African Journal of Root and Tuber Crops*. 3(1): 12 – 15.
- Aiyelari, E.A., Ndaeyo, N.U. and Hyuma, I. 1998. Ergonomic evaluation of fuel power requirement in gari frying. *Journal of Topical Forest Researches* 14(1): 92 – 101.
- Aruofor, R.O. (2000). Review and improvement of data related to wood-products in Nigeria. EC-FAO Partnership Programme (1998-2001) *Tropical forestry Budget line B7-6201/97-15/VIII/FOR PROJECT GCP/INT/679/EC*
- Babbie, E. (1986). *The practice of social research*. California, USA: Wadsworth Publishing, pp. 30.
- Busha, C. H. and Harter, S. P. (1980) *Research methods in librarianship: techniques and interpretation*. San Diego: Academic press, 53.
- Cole, A.H. and Ogungbe, R.F. 1987. Energy intake and expenditure of Nigerian female students. *British Journal of Nutrition*. 57: 309 – 318.
- Forestry Statistics (2003). Policy Information Group, Ministry of Agriculture and Forestry, Wellington.
- Gomez, K. A and Gomez, A. A (1984) *Statistical procedures for Agricultural research*. 2nd edition. John Wiley & Sons, New York.
- IFC, 2007. Environmental, health, and safety guidelines sawmilling and manufactured wood products. *International Finance Corporation*. April 30, 2007
- James H., 2001. Sawmill Chemicals and Carcinogenesis. *Environmental Health Perspectives*. Volume 109 | Number 3 | March 2001
- Jekayinfa S.O. 2007 “Ergonomic Evaluation and Energy Requirements of Bread-baking Operations in South Western Nigeria”. *Agricultural Engineering International: the CIGR Ejournal*. Manuscript EE 07 002. Vol. IX. June, 2007
- Judd H. Michael and Janice K. Wiedenbeck (2004). Safety in the wood products industry. *Forest Products Journal* Vol. 54, No. 10
- Lehman, G. (1962). Physiological measurements as a basis of work organization in industry. *Ergonomics* 1: 328.
- NOHSC, 1998. *Work-related traumatic fatalities in Australia, 1989 to 1992*. AusInfo: Commonwealth of Australia, 1998.
- (NOHSC, 1999). *Work-related traumatic fatalities involving timber activities in Australia, 1989 to 1992. The second work-related fatalities study, 1989 to 1992*. *Epidemiology Unit, National Occupational Health and Safety Commission Sydney, May 1999*
- Raw Materials Research and Development Council (RMRDC), 2003. Multi-disciplinary committee report of a techno-economic survey on Wood and Wood Products Sector (4th update) December 2003. *Pub. Raw Materials Research and Development Council*.
- Robson, (1993) *Real world research a resources for social scientist and practitioners researchers*. Oxford: black well . pg 228.
-
- Segun R. Bello and Yahaya Mijinyawa. “Assessment of Injuries in Small Scale Sawmill Industry of South Western Nigeria”. *Agricultural Engineering International: the CIGR Journal of Scientific Research and Development*. Manuscript 1558. Vol. XII, March, 2010.

Sample Questionnaire

Tick as appropriate in the box provided

1) Name of respondent organization:

2) Location of respondent organization

3) Date of Interview

4) In which sector of the sawmill Industry do you work?

- a) Loader operator, b) Grader c) Maintenance
 d) Log transportation e) Saw miller f) others. (Specify)

5) How long have you been engaged in your present job?

6) Have you ever attended any training on safety about the job you do?

Yes No

7) State the training if (6) is yes:

8) Specify the safety equipment/facilities provided in your job sector

- a)
 b)
 c)
 d)
 e) None

9) State any other facilities that are not available in your place of work.

- a)
 b)
 c)
 d)

10) Have you ever been involved in any accident while doing your job?

Yes No

11).Where did this accident/injury happened?

- a) Sawmill yards and surrounds b) sawmill workshops and production areas
 c) Public roadway

12) What activities are you involved in at the time of the incident

- a) Moving logs to mill b) maintenance c) milling using circular saws
 d) log transport e) Moving timber to stack

13) Nature of Injury

- a) Fracture, b) bruises, c) laceration, sprain, strain,
 d) Heart attack, e) burn, f) others

14) What part of the body was involved in the injury

- a) ankle, b) arm, c) back, d) body/multiple,
 e) Chest, f) Eye, g) foot, h) hand,
 i) Head, j) leg, k) Shoulder, l) other,

15) What suggestions do you have that could reduce the rate of these accidents.