



## SYMPTOMS AND SOME VITAL ORGANS BIOCHEMICAL EVALUATION AMONG SAWMILL OPERATORS IN AMASSOMA, BAYELSA STATE, NIGERIA

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### ABSTRACT

Sawdust is produced from wood by a process called wood-sawing. This study is aimed at the signs and biochemical evaluations of a few vital organs among sawmill workers. Each of the sixty apparently healthy participants had five milliliters of blood taken into lithium heparin anti-coagulated bottles; thirty of them were in the control group and thirty were in the experimental group. Then, using SPSS version 23.0 for statistical analysis, the levels of alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase and C-reactive protein (hepato-inflammatory biomarkers), troponin-1, creatinekinase-MB (cardiac biomarkers), urea, and creatinine (renal biomarkers) were quantitatively measured. The mean levels of the hepato-inflammatory biomarkers alanine aminotransferase (28.40) U/I, aspartate aminotransferase (25.24) U/I, alkaline phosphatase (45.30) U/I, and C-reactive protein (28.92) mg/L in the experimental group were considerably elevated ( $p < 0.05$ ) as compared to that of the control group alanine aminotransferase (9.20) U/I, aspartate aminotransferase (8.10) U/I, alkaline phosphatase (21.42) U/I and C-reactive protein (3.26) mg/L while troponin-1 (0.02) IU/L, creatinekinase-MB (8.00) IU/L, urea (5.73) mmol/L, and creatinine (69.02)  $\mu\text{mol/L}$  (cardio-renal biomarkers) were not significantly altered ( $p > 0.05$ ) in the experimental group compared with the control group troponin-1 (0.01) IU/L, creatinekinase-MB (7.96) IU/L, urea (5.70) mmol/L, creatinine (69.00)  $\mu\text{mol/L}$ . Sneezing (77%), throat irritation (77%), and eye irritation (70%) were the symptoms that considerably developed, whereas others were less than 50%. In conclusion, sneezing, throat irritation, eye irritation and hepato-inflammatory diseases may be connected with sawmill operators having more than five years' worth of work. Therefore, it is advised that sawmill operators in this group be periodically checked for hepato-inflammatory illnesses.

**Keywords:** Amassoma, Biochemical evaluation, Nigeria, Sawmill operators, Symptoms, Vital organs

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### INTRODUCTION

Sawdust, sometimes referred to as the byproduct or waste product of wood, is produced when wood is sawed, sanded, milled, planned, etc [1]. It is one of the most common workplace dangers in the wood sector [2, 3]. It is used in the production of charcoal briquettes, which Henry Ford originally produced in large quantities for commercial usage using the sawdust and wood waste produced by his auto factory [4]. Extended exposure to sawdust may hinder Sawmill operators from meeting their obligations due to an increase in absenteeism which may be triggered by upper and lower respiratory symptoms as shortness of breath, coughing, sputum production, wheezing, cancer, etc. caused by the prolonged exposure [5, 6].

Sawdust has been proven to be a human carcinogen based on pertinent investigations conducted by several researchers. It has been shown through human epidemiological studies that exposure to wood dust, often known as sawdust, may increase the risk of developing nose cancer. Numerous case control studies, cohort studies, and case reports have shown a connection between exposure to sawdust and the development of nasopharyngeal cancer [7]. For instance, wood dust is recognized as carcinogenic in

relation to the nasal cavities and paranasal sinuses in the United States of America by the American Conference of Governmental Industrial Hygienists (ACGIH), National Institute for Occupational Safety and Health (NIOSH), and Occupational Safety and Health Administration (OSHA) lists of factors responsible for carcinogenic effects [8]. Sawdust is primarily utilized as a filler and binder in thermosetting resins, such as those used to make bakelite and linoleum flooring. Sawdust is used mostly as ingredient for wood/plastic composite building products like decks and roof [8].

People who work in sawmills, and sawmill operators in particular, are frequently exposed to wood dust. This is achieved by inhalation, skin or eye contact, or both. Occupational Safety and Health Administration has established a permitted exposure limit for exposure to wood dust in the workplace (15mg/m<sup>3</sup> total exposure and 5mg/m<sup>3</sup> respiratory exposure during the course of an 8-hour workday) based on the information presented above [9].

Despite the multiple negative health impacts linked to sawdust exposure and inhalation, sawmill operators, especially in this research area continue to operate without taking necessary safety procedures while at work. This study, which examined the symptoms and biochemical characteristics of a few key

organs in sawmill operators in Amassoma, was carried out in light of the importance of occupational safety and health to them. But the main purpose of this is to inform the general public, especially sawmill operators, about the potentially detrimental effects of extended exposure to the inhalation of sawdust.

## MATERIALS AND METHODS

### Study area

The location of this investigation was in Amassoma, Bayelsa State. Amassoma is a region in Southern Ijaw of Bayelsa State with 6,970 habitants and it is located in Nigeria at a distance of 298 miles or (480 km) South of Abuja, the Country's capital. It has a latitude of 4° 58'13"N and longitude of 6° 6'32"E.

### Ethical clearance

This study was performed in alignment with the Principle of Helsinki declaration of 1975 as revised in 2008. The informed consent of the respective apparently healthy recruited volunteers was obtained. Also, approval was got from the leaders of Association of sawmill operators Amassoma branch before the commencement of the study.

### Scope of experimental design

In this study, 60 volunteers who appeared to be in good health were chosen at random and divided into two groups as follows:

- (i) Control group: This group was composed of 30 non-sawmill operators who were not smokers and were between the ages of 25 and 45 years. They were white-collar workers by virtue of their occupation.
- (ii) Experimental group: This group was made up of thirty sawmill workers in the age range of 25 to 45 years who appeared to be in good health and had  $\geq 5$  years of experience.

These ostensibly healthy volunteers do not smoke cigarettes, use snuff, or abuse drugs. These lifestyle factors were identified in an effort to rule out the likelihood of its impact on this research findings.

### Sample collection

Five milliliters blood specimen were withdrawn into lithium heparin anticoagulant bottles from all the apparently healthy recruited volunteers using sterile needles. The specimens were spun for 10 minutes at 1500 revolutions / minute to guaranty homogeneity and prevention of blood coagulation. Each of the separated plasma was then quantitatively measured for alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, C-reactive protein, urea, creatinine, troponin-1, and creatine-kinase-MB.

## Biochemical parameters measured with specified methods

### I. Measurement of alanine aminotransferase

This was measured in accordance with the colorimetric method as described by Randox Laboratories Limited, 55, Diamond Road, Crumlin County, Antrim, BT294QY, United Kingdom and modified by Egoro *et al.* [10].

### II. Measurement of aspartate aminotransferase

This was measured in accordance with the colorimetric method as described by Randox Laboratories Limited, 55, Diamond Road, Crumlin County, Antrim, BT294QY, United Kingdom and modified by Egoro *et al.* [10].

### III. Measurement of alkaline phosphatase

This was measured in accordance with the colorimetric endpoint method as described by Randox Laboratories Limited, 55, Diamond Road, Crumlin County, Antrim, BT294QY, United Kingdom and modified by Chukwubike *et al.* [11].

### IV. Measurement of urea

This was measured in accordance with the urease Berthelot method as described by Randox Laboratories Limited, 55, Diamond Road, Crumlin County, Antrim, BT294QY, United Kingdom and modified by Egoro *et al.* [12].

### V. Measurement of creatinine

This was measured in accordance with the Jaffe reaction method as described by Randox Laboratories Limited, 55, Diamond Road, Crumlin County, Antrim, BT294QY, United Kingdom and modified by Obodo *et al.* [13].

### VI. Measurement of C-reactive protein

This was measured in accordance with the latex turbidimetry method as described by Spin-react Diagnostic, Spain and modified by Egoro *et al.* [14].

### VII. Measurement of troponin-1

This was measured in accordance with the dual vial liquid stable immune turbidimetric method as described by Cardiac troponin-1 assay reagents manufactured by Diayme with catalog number DZ145A, United States of America and modified by Christenson *et al.* [15].

### Measurement of creatinekinase-MB (CK-MB)

This was measured in accordance with the immune-inhibition method as described by Atlas Medical reagents manufactured by Atlas Medical unit 4, William James House, Cowley Road, Cambridge, CB40WX and modified by Rashmi and Binta [16].

### Statistical analysis

The results from the quantitatively measured biochemical parameters were expressed as mean and standard deviation using SPSS version 23.0 for statistical analysis, while the data from the apparently

healthy recruited volunteers (control and experimental groups) were analyzed using descriptive statistics of frequency and percentage. The student's "t" tests were used to evaluate the variations between the recruited volunteers (control and experimental groups). Statistical significance was defined as a p-value of 0.05 or lower.

**RESULTS AND DISCUSSION**

In the wood sector, airborne wood dust, sometimes known as sawdust, is the most common occupational hazard. When inhaled and exposed to for an extended

period of time in people, it can cause upper and lower respiratory symptoms as coughing, sputum production, wheezing, and shortness of breath [17].

In this study, the mean values of hepato-inflammatory biomarkers (such as alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, and C-reactive protein) were quantitatively measured in both the control group of seemingly healthy volunteers who were not exposed to inhaling sawdust and the experimental group of seemingly healthy volunteers who had been exposed to inhaling sawdust for a period of ≥5 years as revealed in Table 1.

**Table1:** The hepato-inflammatory biomarkers of control and experimental groups

Parameters	Control group (n=30)	Experimental group (n=30)	p-value	Remarks
ALT (U/I)	9.20 ± 1.04	28.40 ± 3.22	0.03	S
AST (U/I)	8.10 ± 0.98	25.24 ± 2.90	0.04	S
ALP (U/I)	21.42 ± 1.04	45.30 ± 2.10	0.03	S
CRP (mg/L)	3.26 ± 0.82	28.92 ± 3.47	0.02	s

Values are in mean and standard deviation

**Keys:**

- ALT=Alanine aminotransferase
- AST=Aspartate aminotransferase
- ALP=Alkaline phosphatase
- CRP=C-reactive protein
- n=Number of apparently healthy volunteers
- S=Statistically significant

The obtained results revealed that the mean values of alanine aminotransferase (28.40±3.22), aspartate aminotransferase (25.24±2.90), alkaline phosphatase (45.30±2.10) and C-reactive protein (28.92±3.47) were significantly elevated in the experimental group as compared with that of the control group which revealed alanine aminotransferase (9.20±1.04), aspartate aminotransferase (8.10±0.98), alkaline phosphatase (21.42±1.04) and C-reactive protein (3.26±0.82).

The substantial increases in the liver enzymes alanine aminotransferase, aspartate aminotransferase, and alkaline phosphatase may indicate hepatocellular injury brought on by the detrimental effects of sawdust toxins, which may have led the liver to release these enzymes into the bloodstream. This result is not consistent with the earlier research of [18] who in their study found that these parameters were not altered significantly. However, the concentration of exposure and inhalation of this sawdust may be responsible for this.

However, the considerable increase in the mean C-reactive protein level of the experimental group (28.92±3.47) as compared with that of the control group (3.26±0.82) may be due to the experimental volunteers' bodies bio-accumulation of sawdust, which may have caused systemic inflammation and the release of cytokines that may have prompted an increase in the production of C-reactive protein, a marker of an inflammatory disorder. This result is consistent with the earlier research of [19].

Cardio-renal biomarkers (such as troponin-1, creatine-kinase-MB, urea, and creatinine) in the plasma samples of both the apparently healthy volunteers who were not exposed to inhaling sawdust, who served as the control group, and the apparently healthy volunteers who had been exposed to inhaling sawdust for a period of ≥5 years were quantitatively measured as shown in Table 2.

**Table 2:** The cardio-renal biomarkers of control and experimental groups

Parameters	Control group (n=30)	Experimental group (n=30)	p-value	Remarks
Troponin-1 (IU/L/)	0.01 ± 0.00	0.02 ± 0.01	0.78	NS
CK-MB (IU/L/)	7.96 ± 1.17	8.00 ± 1.25	0.85	NS
Urea (mmol/L)	5.70 ± 1.22	5.73 ± 1.26	0.65	NS
Creatinine (µmol/L)	69.00 ± 3.51	69.02 ± 3.53	0.72	NS

Values are in mean and standard deviation

**Keys:**

CK-MB = Creatine-kinase-MB

n=Number of apparently healthy volunteers

NS=Not statistically significant

The results revealed that the mean values of troponin-1 (0.02±0.01) and creatine-kinase-MB (8.00±1.25) were not significantly elevated in the experimental group as compared with that of the control group troponin-1 (0.01±0.00) and creatine-kinase-MB (7.96±1.17). This finding may be suggestive that occupational exposure to sawdust for a period of ≥5 years has no detrimental effect on the status of the heart.

The results further revealed that the mean values of urea (5.73±1.26) and creatinine (69.02±3.53) were not significantly elevated in the experimental group as compared with that of the control group urea (5.70±1.22) and creatinine (69.00±3.51). This finding as established in this study which is suggestive that occupational exposure to sawdust for a period of ≥5 years has no detrimental effect on the status of the

kidney is not in alignment with the previous work of [20]. The concentration of sawdust exposure and inhalation may attribute to this finding.

As shown in Table 3, the percentage of apparently healthy volunteers in the experimental group with abnormal values i.e. values greater than the maximum reference range of the measured biochemical parameters revealed C-reactive protein (83)%, alanine aminotransferase (70)%, aspartate aminotransferase (60)%, alkaline phosphatase (60)%, urea (10)%, creatinine (10)%, troponin-1 (0)% and creatine-kinase-MB (0)%. This discovery, which showed substantial increases in alanine aminotransferase and C-reactive protein, could be a pointer to hepato-inflammatory diseases.

**Table 3:** Percentage of volunteers in the experimental group with abnormal values as compared with that of the control group

Parameters	Reference range (n=30)	Control group (n=30)	Experimental group
CRP (mg/L)	≥6.0	(0)0	(25) 83%
ALT (U/I)	Upto 12	(0)0	(22) 70%
AST (U/I)	Upto 12	(0)0	(18) 60%
ALP (IU/I)	9-35	(0)0	(3) 10%
Urea (mmol/L)	1.7-9.1	(0)0	(3) 10%
Creatinine (µmol/L)	53-97	(0)0	(0)0 %
Troponin-1 (IU/L)	≤0.03	(0)0	(0)0 %
CK-MB (IU/L)	5-25	(0)0	(0)0 %

The number of volunteers is captured in parenthesis while their respective percentage are expressed in values

**Keys:**

ALT= Alanine aminotransferase

AST= Aspartate aminotransferase

ALP = Alkaline phosphatase

CRP = C-reactive protein

CK-MB = Creatine-kinase-MB

The detected symptoms and their corresponding percentages among the seemingly healthy volunteers who had been exposed to sawdust inhalation for five or more years as a result of their profession are shown in Table 4.

The results revealed sneezing (77)%, throat irritation (77)%, eye irritation (70)%, cough (50)%,

catarrh (50)%, nausea (27)%, gastrointestinal tract anorexia (0)%, abdominal cramps (0)% and vomiting (0)%. According to this finding, extended exposure to sawdust for a period of five or more years may cause considerable manifestations of sneezing, throat irritation and eye irritation, which are thought to be impacted by toxins present in sawdust.

**Table 4:** Observed symptoms and their respective percentages among sawmill operators

Symptoms	Number of volunteers	Response	Percentage
Sneezing	30	23	77
Throat – irritation	30	23	77
Eye- irritation	30	21	70
Cough	30	15	50
Catarrh	30	15	50
Nausea	30	8	27
Gastrointestinal tract anorexia	30	0	0
Abdominal cramps	30	0	0
Vomiting	30	0	0

**CONCLUSION**

It is concluded from this study that sawmill operators with ≥5 years working experience may be prone to hepato-inflammatory disorders with significant manifestations of sneezing, throat irritation and eye irritation.

**RECOMMENDATIONS**

Based on the findings from this study the following are recommended:

- a. Sawmill operators should be enlightened by the relevant authorities on the dangers of continuous exposure and inhalation of sawdust without taking appropriate safety measures such as the use of nose mask, leather gloves, goggles and faceplate
- b. Sawmill operators with ≥5 years working experience should be assessed intermittently for hepato-inflammatory disorders in any registered and licensed Medical Laboratory facility

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