

ASSESSMENT OF HEALTH RISKS AND PREVENTION PRACTICES ASSOCIATED WITH MEDIUM DENSITY FIBREBOARD (MDF) DUST EXPOSURE AMONG FURNITURE CRAFTSMEN IN KATSINA STATE, NIGERIA

Haruna Abdulkadir

Department of Technical Education
College of Vocational and Technical Education
Hassan Usman Katsina Polytechnic, Katsina State, Nigeria

Abstract

This study examined the health risks and prevention practices related to exposure to medium density fibreboard (MDF) dust among furniture craftsmen in Katsina State, Nigeria. The research focused on 186 micro-scale furniture factories, including 168 furniture craftsmen and 18 factory managers from three senatorial zones of Katsina State. The sample consisted of 127 respondents, comprising 113 furniture craftsmen and 14 factory managers, selected using the sampling table by Krejcie and Morgan (1970). The study utilised a descriptive survey design and a 26-item structured questionnaire titled "Health Risks Assessment and Prevention Practices Questionnaire (HERAPPQ)" for data collection. This validated questionnaire included sections on general data, potential health risks, and safe practices related to MDF dust exposure, with responses collected on a five-point Likert scale. Two null hypotheses were tested at a 0.05 level of significance. Data analysis using z-tests revealed significant differences in both hypotheses, indicating that factory managers are more aware of health risks than furniture craftsmen, and there are differing views on the implementation of safe practices. Findings emphasize the need for targeted educational and training programmes to improve awareness and adherence to safe practices among furniture craftsmen. Recommendations include comprehensive training programmes on the health hazards of MDF dust, the correct use of personal protective equipment (PPE), and the establishment and enforcement of rigorous workplace safety policies. These measures aim to ensure the health and safety of all workers exposed to MDF dust.

INTRODUCTION

Furniture greatly influences the functionality and visual appeal of spaces, encompassing tables, chairs, sofas, and storage units to facilitate various activities (Porter, 2001). Wood is a highly favoured material for furniture due to its enduring charm, strength, and versatility, making it suitable for a wide range of furniture pieces (Copeland, 2020). The variety of wood options ranges from rich mahogany to the lighter qualities of oak, catering to diverse tastes and design preferences. Its natural beauty and ability to be crafted into intricate patterns enhance its enduring popularity in furniture design.

Wood is abundant in botanical specimens with persistent foliage and year-round branching patterns, making it a significant component in engineering materials. It is a complex biological entity with diverse chemical compositions and cellular configurations that support the plant's essential processes (Hou et al., 2021). Described as viscoelastic,

porous, anisotropic, and nonhomogeneous, wood, as a biopolymer, has mechanical properties influenced by temperature, moisture content, structure, and chemical composition (Hou et al., 2021).

One of the significant advantages of wood is its renewability. Sustainable forest management and harvesting practices can ensure the indefinite availability of wood. Wood offers environmental benefits, being the most widely used and versatile building material with applications ranging from bridges to paper and heating homes (Forest Products Laboratory, 2010; Woodford, 2021). The byproducts from each stage of wood production can be repurposed and reused (Dix, 2016). Harvested wood is transformed into timber and various wood products, with the remaining materials used for energy production, ensuring minimal waste. With proper care and maintenance, solid wood and composite materials like plywood, Oriented Strand Board (OSB), and fiberboards can last for generations. Engineered wood products (EWPs) showcase the ingenuity of modern technology in fully utilizing natural resources (Obinna, 2020).

Engineered wood is created by combining hardwoods and softwoods with adhesives and bonding wood particles, fibres, or veneers through compression. This process produces sheet materials suitable for a wide range of applications and helps to repurpose wood waste. According to Dix (2016), waste wood from sawmills is treated chemically or with heat to produce wood panels of specific sizes that are difficult to find in nature.

Engineered wood products are utilized in commercial buildings, industrial products, and home construction. Unlike solid wood, they are processed to perform differently and often with superior qualities (Copeland, 2020). Advances in structural applications of wood have been made over the last 25 years due to reduced access to high-strength first-growth timber and the development of new manufactured wood products (Williams, 2018).

Engineered wood products are eco-friendly and efficient, generating little waste. They include plywood, Oriented Strand Board (OSB), laminated boards, particle boards, and fiberboards, which come in high, medium, and low density (Williams, 2018). Medium Density Fiberboard (MDF) is produced by shredding wood into fibrous pieces and bonding them with natural or synthetic resin. MDF can be manufactured via wet or dry processes. Wet processes utilize natural wood adhesives to fuse fibres, while dry processes use synthetic resin adhesives.

Medium-density fiberboard (MDF) is commonly used in residential furniture construction and home decor due to its strength, stability, and lack of wood grain and knots. It offers a smooth finish, precise machining, and intricate patterns, making it versatile for the furniture and cabinet industries. MDF comes in various textures, natural wood colour imitations, and designed patterns. However, a significant concern is the exposure to fine dust and formaldehyde gas emitted from the urea-formaldehyde adhesive used in its production.

Urea-formaldehyde (UF) resins, which have been in use since 1928, account for approximately 15% of thermoset resin production. These resins are highly valued for their cost-effectiveness, rapid curing, water solubility, non-flammability, and resistance to heat and electricity. However, concerns regarding the safety of UF resins arise from the formaldehyde content used in the production of medium-density fiberboard (MDF). Formaldehyde, classified as a group-1 carcinogen by the International Agency for Research on Cancer, is associated with occupational hazards. Notably, formaldehyde is a flammable, colourless gas with a pungent odour and poses significant health risks if mishandled. Furthermore, MDF manufactured with UF may emit formaldehyde over an extended period (United States Environmental Protection Agency, 2021). Workplace Exposure Limits (WELs) for formaldehyde have been established at 2.5 mg/m³ or 2 ppm (Centre for Occupational and Environmental Medicine, 2010). For wood dust,

WELs stand at 3 mg/m³ for hardwood and 5 mg/m³ for softwood (based on an 8-hour time-weighted average), with the stricter limit applied in the presence of MDF. At concentrations of 0.3–0.9 ppm, formaldehyde can cause skin irritation, dermatitis, and eye irritation (National Research Council United States Committee on Toxicology, 1980), and levels of 1-11 ppm can result in upper airway irritation in workers handling UF resin-coated nylon (Madl et al., 2008).

Woodworking involving MDF poses additional risks due to the dust generated during sawing, sanding, and drilling activities. Inhalation of excessive dust can overwhelm the respiratory system's defences and lead to various health issues (Yuan et al., 2014). The health impact is influenced by factors including the chemical composition of the dust, particle density in the air, dust location in the respiratory system, and duration of exposure (Barbosa et al., 2018). Notably, furniture craftsmen, also referred to as furniture and cabinet makers, are particularly susceptible to dust exposure, with various factors such as machinery type, work methods, tools, and material water content influencing their level of exposure (Thetkathuek et al., 2016).

Considering these occupational hazards, it is imperative to address the health and environmental implications associated with the use of Medium-Density Fibreboard (MDF) in furniture production. Ensuring the appropriate use of Respiratory Protective Equipment (RPE) to mitigate wood dust exposure is critical. Educating furniture craftsmen on the risks associated with MDF dust exposure will promote safer practices, contributing to a healthier working environment and reduced environmental impact. This study aims to evaluate the health risks and preventive measures for medium-density fibreboard (MDF) dust exposure among furniture craftsmen in Katsina state.

RESEARCH HYPOTHESES

Two hypotheses were formulated for the study to compare the mean responses of furniture craftsmen and factory managers regarding the potential health risks and safe practices associated with medium-density fiberboard dust exposure. The hypotheses were tested at a significance level of 0.05.

MATERIALS AND METHOD

The research adopted a descriptive survey research design to assess health risks and preventive measures for medium-density fibreboard (MDF) dust exposure among furniture craftsmen in Katsina state, Nigeria. The study encompassed 12 local government areas in Katsina State, which is notable for its substantial population of furniture craftsmen utilising MDF in their production processes. With the state's annual furniture production valued at over N 4 billion, it presented an ideal setting to evaluate health risks and prevention practices associated with MDF dust exposure among this demographic.

The study focused on 186 micro-scale furniture factories, comprising 168 furniture craftsmen and 18 furniture factory managers from three senatorial zones of Katsina State. The sample size for the research comprised 127 respondents, consisting of 113 furniture craftsmen and 14 furniture factory managers, selected using the sampling table by Krejcie and Morgan (1970).

Data collection employed a 26-item structured questionnaire titled "Health Risks Assessment and Prevention Practices Questionnaire (HERAPPQ)," developed by the researcher. The questionnaire featured two sections: Section I encompassed general data and guidelines. At the same time, Section II comprised two segments - A and B. Segment A sought information on potential health risks associated with exposure to MDF dust. At the same time, Segment B focused on safe practices to mitigate the hazards of MDF dust on personal health and the environment. Responses

were collected using a five-point rating scale: Strongly Agree – 5, Agree – 4, Moderately Agree – 3, Disagree – 2, and Strongly Disagree – 1. The questionnaire underwent validation by two lecturers and health personnel to ensure its accurate measurement of the intended construct and relevance to the research question.

Furthermore, a pilot study involving 10 furniture craftsmen and 5 factory managers in Zaria town was conducted using a modified instrument. The Cronbach’s Alpha statistic showed a high internal consistency, with a reliability coefficient of 0.96, indicating the instrument’s reliability.

RESULTS AND DISCUSSIONS Table 1 Z-Test Analysis of the mean responses on possible health risks when furniture craftsmen are exposed to medium-density fibreboard dust

Group	N	\bar{x}	SD	df	Z-value	P-value, Sig. (2-tailed)	Alpha Level
Furniture Craftsmen	113	2.87	1.04				
Factory Managers	14	4.13	0.69	125	-20.31	0.00	0.05 Rejected

The analysis presented in Table 1 showed the z-test result of the mean difference between the mean responses of Furniture Craftsmen and Factory Managers regarding potential health risks when Furniture Craftsmen are exposed to medium-density fiberboard dust. The p-value [Sig. (2-tailed)] of 0.00 is less than 0.05 ($p \leq 0.05$), leading to the rejection of the null hypothesis. Consequently, there exists a significant difference in the mean responses of Furniture Craftsmen and Factory Managers concerning potential health risks when Furniture Craftsmen are exposed to medium-density fiberboard dust. The findings suggest that Factory Managers are more conscious of the possible health risks than Furniture Craftsmen.

Table 2 Z-Test analysis of the mean responses of furniture craftsmen and furniture factory managers on the safe practices employed to prevent the hazards of medium-density fibreboard dust.

Group	N	\bar{x}	SD	df	Zvalue	P-value, Sig. (2tailed)	Alpha Level	Decision
Furniture Craftsmen	113	2.03	0.76	125	-9.11	0.00	0.05	Rejected
Factory Managers	14	3.88	0.70					

In Table 2, the analysis revealed the z-test result of mean responses of Furniture Craftsmen and factory Managers regarding the safe practices for preventing hazards associated with medium-density fiberboard. The obtained p-value [Sig. (2-tailed)] of 0.00 is less than 0.05 ($p \leq 0.05$), leading to the rejection of the null hypothesis. This indicates a significant difference in the mean responses of Furniture Craftsmen and factory Managers concerning the safe practices to be employed to prevent the hazards of medium-density fiberboard dust on personal health and the environment. The mean suggests that there is no difference between factory managers and furniture craftsmen in their views on the safe practices to prevent the hazards of medium-density fiberboard dust on personal health and the environment.

CONCLUSION

While factory managers show increased awareness of the health risks associated with MDF dust, both factory managers and furniture craftsmen acknowledge the crucial importance of implementing safe practices to mitigate these hazards. This underscores the need for focused educational and training programs aimed at raising awareness among furniture craftsmen regarding the health risks and best practices related to MDF dust exposure. Such measures are vital to ensure the health and safety of all individuals working in environments where MDF dust exposure is common.

RECOMMENDATIONS

To bridge the identified knowledge and practice gaps, it is recommended to create comprehensive training programs for Furniture Craftsmen, with a focus on raising awareness about the health hazards associated with MDF dust exposure and the correct usage of personal protective equipment (PPE). These programs should involve regular workshops and refresher courses to ensure continuous education. Moreover, it is crucial to establish and strictly enforce workplace safety policies that mandate the use of PPE and adherence to safe handling practices for MDF materials. Factory Managers should actively oversee compliance with these policies, conduct regular health assessments, and monitor the environment to identify and mitigate potential risks. This integrated approach aims to cultivate a culture of safety and accountability, thus safeguarding the health and well-being of all workers exposed to MDF dust.

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