Level of Awareness on Occupational Hazard in the Processing of Medium Density Fibreboard on Furniture Craftsmen in Katsina State, Nigeria.

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Abstract

The study was designed to determine the level of awareness on occupational hazard in the processing of medium density fibreboard on furniture craftsmen in katsina state. Three research questions and three null hypotheses guided the study. A descriptive survey research design was adopted for the study. The targeted population for the study was 40 respondents consisting of 10 Furniture Factory Managers and 30 furniture craftsmen who were selected from 10 registered furniture factories from the four major local government areas of katsina state. A structured questionnaire (AHHMDFFC) containing 35 items was used for the study. Mean, Standard Deviation and t-test were used to analyse the data collected for the study. The null hypotheses were tested at a 0.05 level of significance. The findings indicates that both furniture craftsmen and factory managers acknowledge the health challenges posed by MDF dust and the effects of the MDF dust on personal health, However, the factory managers have a greater understanding of these effects. It was discovered that the effects can be reduced if the furniture craftsmen can adhere strictly to the safe practices in their activities with Medium Density Fibreboard. Based on the findings, it was recommended among others to increase awareness and education on its risks, provide additional training on personal health effects, and encourage adherence to safe practices for preventing harm.

Introduction

Wood evolved over millions of years to serve three main functions in plants: conduction of water, mechanical support, and storage of biochemical materials (Wiedenhoeft, 2010). Wood is a renewable resource with environmental benefits, making it suitable for a wide range of applications (Hou *et al*., 2021). Woodford (2021) and Dix (2016) both emphasize the importance of wood as a suitable material for furniture. It is super-strong, super-warm and super-sturdy, and can last hundreds or thousands of years. Additionally, biproducts from every stage of the wood production process can be reused and repurposed.

Obinna (2020) discusses the process of harvesting wood into timber, which is then converted into other wood products and recovered for energy production. Wood is a long-lasting natural material that can last for generations and is nearly effortless to maintain. Solid wood and other composite materials such as Plywood, Oriented Strand Board (OSB) and Fibreboards used for furniture can last for generations with minimum care and it is nearly effortless to maintain. These reconstructed wood products derived using such means are generally referred to as engineered wood products (EWPs).

Engineered wood is a sheet material produced by pressing and bonding together wood particles, fibres, or veneers to achieve characteristics and create a use for waste. Engineered wood is a type of wood that is being processed to be slightly different and performs in a different way than the solid wood it would perform. Williams (2018) and Copeland (2020) have both noted changes in how wood has been used in structural applications over the last 25 years due to reduced access to high-strength timber from first-growth forests and the development of new configurations of manufactured wood products. These materials, referred to as Engineered Wood Products are manufactured to using more of the available fibre resource with little waste, and provide new potential for use both as primary and secondary structural components. They include Plywood,

Oriented Strand Board (OSB), Laminated Boards, Particle Boards and Fibreboards. Fibreboard come in three types: high, Medium, and low density.

Medium Density fibreboard is a type of fibreboard made from cellulosic fibres combined with a synthetic resin or other suitable bonding system and joined together under heat and pressure. It is produced using either a 'Wet' or 'Dry' process. The main source of material for manufacturing fibre building boards is trees grown to be used as wood pulp, Forest thinning and Sawmill residue. MDF is manufactured using a 'dry' process, which differs from the 'wet process' in that the wood fibres are not pulped into a slurry.

Kara (2017) found that MDF is strong and stable when used and free from wood grain and knots, making it ideal for residential construction and home decoration. It was initially less durable than good old solid wood, but with the rapid progress of technology and modern manufacturing techniques, engineered woods have become more reliable and cheaper. MDF is widely used in furniture and cabinet industries due to its excellent surface and moulding characteristics, but its main concern is exposure to fine dust and formaldehyde gas from the Urea-Formaldehyde adhesive used in its production.

Urea-formaldehyde (UF) is a colourless water-soluble resin that has been in commercial production since 1915 and accounts for 15% of the total thermoset resin production. It is the most important amino resin due to its low cost, high reactivity, solubility in water, fast curing, film clarity, non-flammability, compactness, good resistance to heat and electricity. Akinterinwa et al. (2015) have studied its use in various applications, including the use of pure, modified, and incorporated forms. This adhesive property has also established UF resins' potentials as binders in woodworks and functional coatings, used mostly as adhesives for the bonding of plywood, particleboard, and other man-made wood products (Ferra *et al*., 2011). In contemporary society, there is hardly any occupation or human activity that is not associated with occupational hazards which could adversely affect the health of workers (Inah *et al*., 2019). Formaldehyde is a colourless, flammable gas at room temperature and has a strong odour. Exposure to formaldehyde may cause adverse health effects. MDF made with UF may emit formaldehyde gas for months or years after it is manufactured (United States Environmental Protection Agency, 2021). Research have shown that Formaldehyde cause irritation and dryness of the nose and throat and Nose blindness. Upper airway irritation attributed to formaldehyde at 1–11 ppm occurred in employees handling nylon fabric coated with urea-formaldehyde resin.

The second concern is the dust generated during MDF processing, which can be classified into cutting and sanding dust particles. When inhaled, the dust can overload the respiratory system and cause various health effects. The severity of these effects depends on the chemical composition, density of particles, storage location in the respiratory system, and duration of exposure. Furniture craftsmen who work with MDF are exposed to this dust, and the airborne concentration and size distribution depend on the machinery, work, accessories, tools, and water content in the material.

Furniture making is an age-long practice and primarily a means of livelihood for the Craftsmen and their families. However, there is evidence that most of them are exposed to several workplace hazards which constantly deteriorate their health on daily basis. This is why companies and industries have been employed by regulatory authorities to prioritize safety measures to protect the health of workers at the workplace Adei & Kunfaa, 2007. Occupational

exposure to MDF dust in the workplace can have a wide range of adverse effects on Furniture Craftsmen health.

Aim and Objectives of the Study

The study is designed to determine the Level of Awareness on Occupational Hazard in the Processing of Medium Density Fibreboard on Furniture Craftsmen in Katsina State, Nigeria. Specifically, the objectives of the study are to:

1. Identify the health challenges that could be caused by Medium Density Fibreboard dust.
2. Examine the level of awareness of Furniture Craftsmen on the effects of Medium Density Fibreboard dust on personal health.
3. Identify the safe practices that should be employed to prevent the effects of Medium Density Fibreboard dust on personal health and the environment.

Significance of the Study

This study on occupational exposure to wood dust and other harmful chemicals will serve as a baseline survey for future research. The beneficiaries of this study include Furniture Craftsmen in Katsina State, the Katsina State Furniture Makers Association, managers of furniture factories, Environmental Health workers, and Woodwork teachers. The Furniture Craftsmen will become fully aware of the hazards associated with their activities and will be encouraged to adopt protective measures against adverse health effects caused by workplace hazards. Occupational health and safety are crucial aspects of human concern as it aims to promote and maintain the highest degree of physical, mental, and social well-being of workers in all occupations. The data generated from this study will help the Katsina State Carpenters Association to plan, implement, and strategize intervention programs that will curb occupational hazards at workplace outlets. These programs will include workshops and seminars for furniture craftsmen to sensitize them on the adverse effects of the materials used for furniture construction.

The study's findings have important implications for various stakeholders in the furniture industry. Furniture factory managers in Katsina can use the results to enhance their awareness of the hazards associated with the use of Medium Density Fibreboard (MDF) and ensure that all furniture makers under their watch wear appropriate Personal Protective Equipment (PPE) and Respiratory Protective Equipment (RPE). The findings can also guide environmental health planners and policymakers in formulating policies to enforce safety standards for employers and employees in the furniture industry. Furthermore, the study can be helpful for woodwork teachers in ensuring that their students utilize the correct RPE while using MDF for practical purposes in school workshops.

Research Questions

The following research questions will guide the study:

1. What are the health challenges that could be caused by Medium Density Fibreboard dust?
2. What is the level of awareness of Furniture Craftsmen on the effects of Medium Density Fibreboard dust on personal health?

3. What are the safe practices that should be employed to prevent the effects of Medium Density Fibreboard dust on personal health and the environment?

Hypotheses

The following hypotheses formulated will be tested at 0.05 level of significance:

Ho_1: There is no significant difference in the mean responses of Furniture Craftsmen and furniture factory managers on the health challenges that could be caused by Medium Density Fibreboard dust.

Ho_2: There is no significant difference in the mean responses of Furniture Craftsmen and furniture factory managers on their level of awareness of the effects of Medium Density Fibreboard dust on personal health.

Ho_3: There is no significant difference in the mean responses of Furniture Craftsmen and furniture factory managers on the safe practices employed to prevent the effects of Medium Density Fibreboard dust on personal health and environment.

Methodology

The research design adopted for this study was a descriptive survey research design. A descriptive survey employs the use of questionnaires, interviews and direct observation to ascertain the opinions, attitudes, perceptions and preferences of individuals under study. This study was carried out in Four local government arear of Katsina State. The targeted population for his study consists of 40 comprising 30 Furniture Craftsmen and 10 Furniture factory managers from registered furniture factories. A structured questionnaire titled: Awareness on health hazard of Medium Density Fibreboard by furniture craftsmen (AHHMDFFC) containing 35 items was used to collect the needed data from the respondents. The questionnaire items were structured using a five-point rating scale with response options of Very Highly Aware (VHA) – 5, Highly Aware (HA) – 4, Moderately Aware (MA) – 3, Not Aware (NA) – 2, Highly Not Aware (HNA) – 1 and Strongly Agree (SA) – 5, Agree (A) – 4, Undecided (UD) – 3, Disagree (D) – 2, Strongly Disagree (SD) – 1 for the research questions. The instrument for data collection was face validated for content and construct by two lecturers in the Department of Industrial and Technology Education, Federal University of Technology, Minna and one health personnel from FUT Clinic Minna. The final instrument was trial tested in Minna town using a population of 5 furniture factory managers and 7 Furniture Craftsmen. Cronbach's Alpha value of 0.88 was obtained. The data was analysed using Mean and Standard Deviation. The three null hypotheses were tested at a 0.05 level of significance.

Results

Table 1: Mean responses of the respondents on the health challenges that could be caused by Medium Density Fibreboard dust.

S/N	ITEM	$\bar{x}_1$	SD_1	Remark	$\bar{x}_2$	SD_2	Remark	$\bar{x}_A$	SD_A	Remark
1	Medium Density Fibreboard (MDF) dust and Formaldehyde causes eye irritation	3.13	1.04	MA	4.10	0.74	A	3.62	0.89	A

2	Skin irritation	3.10	0.99	MA	4.20	0.63	A	3.65	0.81	A
3	Dermatitis	3.00	0.79	MA	4.10	0.74	A	3.55	0.76	A
4	Nasal inflammation	2.73	1.08	MA	4.30	0.95	A	3.52	1.02	A
5	Asthma	2.70	1.15	MA	3.90	0.74	MA	3.3	0.94	MA
6	Lower chest discomfort	2.73	1.14	MA	4.00	0.67	A	3.37	0.91	MA
7	Presence of formaldehyde in the air may cause an individual to experience watery eyes	2.97	1.27	MA	4.00	0.47	A	3.49	0.87	A
8	Coughing and sneezing	2.97	1.07	MA	4.30	0.48	A	3.64	0.78	A
9	Dryness of the throat	2.90	1.06	MA	4.60	0.52	A	3.75	0.79	A
10	Nose and throat irritation	3.00	0.87	MA	4.30	0.68	A	3.65	0.77	A
11	Shortness of breath	2.80	1.10	MA	4.20	0.79	A	3.5	0.94	A
12	Wheezing and changes in lung function	2.77	1.01	MA	4.10	0.74	A	3.44	0.87	MA
13	People with asthma or other breathing problems may be more sensitive to the effects of formaldehyde	2.90	1.16	MA	4.40	0.84	A	3.65	1.00	A
				N_1=30			**N_2=10**			

Key: N_1 = Number of Furniture Craftsmen, **N_2** = Number of Factory Managers, **$\bar{x}_1$ =** Mean Responses of Furniture Craftsmen, SD_1 = Standard Deviation of Furniture Craftsmen, **$\bar{x}_2$ =** Mean Responses of Factory Managers, **SD_2** = Standard Deviation of Factory Managers, **$\bar{x}_A$ =** Average Mean Responses of All respondents, **SD_A =** Average Standard Deviation.

Table 1 presents data on the health challenges caused by Medium Density Fibreboard dust, based on responses from furniture craftsmen and factory managers. The craftsmen moderately agreed on the health challenges, with mean responses ranging from 2.70 to 3.13 and standard deviation ranging from 0.79 to 1.27. The factory managers agreed more strongly, with mean responses ranging from 3.90 to 4.60 and standard deviation ranging from 0.47 to 0.95. The standard deviations indicate that respondents were consistent in their responses, with little variation from the mean.

Table 2: Mean responses of the respondents on the level of awareness of Furniture Craftsmen on the effects of Medium Density Fibreboard dust on personal health

N_1=30 N_2=10

S/N	ITEM	$\bar{x}_1$	SD_1	Remark	$\bar{x}_2$	SD_2	Remark	$\bar{x}_A$	SD_A	Remark
1	Inhaled wood dust causes allergic rhinitis	2.43	0.77	NA	3.40	0.70	MA	2.92	0.74	MA
2	Inhaling MDF dust can cause chronic bronchitis	2.40	0.77	NA	4.20	0.79	HA	3.30	0.78	MA
3	Occupational Asthma can be a result of MDF dust	2.40	0.89	NA	3.90	0.99	HA	3.15	0.94	MA
4	Inhaling MDF dust can cause impairment of lung function	2.37	0.81	NA	4.10	0.99	HA	3.24	0.90	MA
5	MDF dust causes skin irritation and itching	2.17	0.83	NA	4.10	0.74	HA	3.14	0.79	MA
6	Excessive inhalation of MDF dust can cause various health effects	2.03	0.85	NA	4.00	0.94	HA	3.02	0.90	MA
7	Dermatitis can occur because of chemicals from woods	2.20	0.89	NA	4.10	0.74	HA	3.15	0.81	MA
8	MDF dust can cause allergic reactions	2.07	0.94	NA	4.40	0.70	HA	3.24	0.82	MA
9	Prolonged MDF dust exposure can cause Hypersensitivity pneumonitis	2.27	0.76	NA	4.20	0.92	HA	3.24	0.85	MA
10	Hypersensitivity pneumonitis begins with headache, chills, sweating, nausea, and breathlessness	2.30	0.65	NA	3.70	0.82	HA	3.00	0.74	MA
11	Prolonged exposure to formaldehyde can result in nasal cancer	2.30	0.92	NA	4.10	0.88	HA	3.20	0.90	MA
12	Prolonged exposure to formaldehyde can result in sinus cancer	2.40	0.72	NA	3.70	0.68	HA	3.05	0.70	MA
13	Formaldehyde emission causes conjunctival irritation	2.23	0.77	NA	4.30	0.68	HA	3.27	0.72	MA

14	Repeated exposure to formaldehyde may cause bronchitis on skin and asthma-like allergy	2.37	0.85	NA	4.10	0.74	HA	3.24	0.79	MA
15	Some people are not sensitive to formaldehyde	2.40	0.89	NA	4.00	0.67	HA	3.20	0.78	MA
16	Watery eyes; burning sensations in the eyes, nose, and throat; coughing; wheezing; nausea; and skin irritation are short term effects of formaldehyde	2.33	0.80	NA	4.30	0.82	HA	3.32	0.81	MA

Table 4.2 showed the level of awareness of furniture craftsmen and factory managers on the effects of Medium Density Fibreboard dust on their personal health. Furniture craftsmen had mean responses of 2.03-2.43, while factory managers had mean responses between 3.40-4.30. The standard deviation of the furniture craftsmen was 0.65-0.94, while that of the factory managers was 0.67-0.99. This suggests that the respondents were not far from the mean and from one another in their opinions.

Table 3: Mean responses of the respondents on the safe practices that should be employed to prevent the effects of Medium Density Fibreboard dust on personal health and the environment.

N_1=30 N_2=10

S/N	ITEM	$\bar{x}_1$	SD_1	Remark	$\bar{x}_2$	SD_2	Remark	$\bar{x}_A$	SD_A	Remark
1	Safety goggles should be used while working with MDF	3.80	0.81	A	4.00	0.94	A	3.90	0.88	A
2	Hand gloves and Apron should be used while working with MDF	4.17	0.70	A	3.70	0.82	A	3.94	0.76	A
3	MDF should be processed for furniture where there is adequate ventilation	3.93	0.83	A	4.10	0.88	A	4.02	0.86	A
4	MDF should be used where there is low humidity and moisture that will retard the breaking down of the formaldehyde into gas	4.23	0.90	A	3.70	0.68	A	3.97	0.79	A
5	Keep dust levels down with good housekeeping	3.97	0.67	A	4.40	0.70	A	4.19	0.69	A
6	Use a respirator with cartridges approved for dust and formaldehyde	3.97	0.81	A	4.10	0.74	A	4.04	0.78	A
7	Good hygiene includes washing whenever you get dirty, and shower and launder clothes at the end of the day	3.97	0.62	A	4.10	0.74	A	4.04	0.68	A
8	Employers should conduct air monitoring or have documentation	4.33	0.61	A	4.30	0.82	A	4.32	0.72	A

	that shows exposure limits									
9	Workers' average daily exposure must be below 0.75 ppm	4.37	0.77	A	4.20	0.63	A	4.29	0.70	A
10	All structures fabricated from MDF products must be sealed with paint or varnish prior to becoming operational, to prevent the release of formaldehyde gas	3.97	0.77	A	2.30	0.48	D	3.14	0.63	MA
11	All staff working with MDF products should be made aware of the possible adverse health effects that may be experienced	4.17	0.83	A	2.50	0.85	MA	3.34	0.84	MA
12	PPE should be cleaned in mild soap and water after use to remove dust	3.83	0.79	A	2.70	1.06	MA	3.27	0.93	MA
13	MDF dust must be disposed of immediately from vacuum cleaner dust storage bags on completion of the clean-up to avoid further exposure	4.33	0.71	A	2.70	0.68	MA	3.52	0.70	A

Table 3 presents safe practices to prevent the harmful effects of Medium Density Fibreboard dust on personal health and the environment. Furniture craftsmen and factory managers both agreed on these safe practices, with mean responses ranging from 3.80 to 4.37 and 2.30 to 4.40, respectively. The standard deviation for both groups was relatively small, indicating that the respondents were close to the mean and had similar opinions.

Ho_1: There is no significant difference in the mean responses of Furniture Craftsmen and furniture factory managers on the health challenges that could be caused by Medium Density Fibreboard dust.

Table 4: Z-Test analysis of the mean responses of Furniture Craftsmen and furniture factory managers on the health challenges that could be caused by Medium Density Fibreboard dust.

Group	N	$\bar{x}$	SD	df	Z-value	P-value, Sig. (2-tailed)	Alpha Level	Decision
Furniture Craftsmen	30	2.90	1.06					
				38	-19.52	0.00	0.05	Rejected
Factory Managers	10	4.19	0.69					

*Significant at $p \leq 0.05$.
Key: p-value = probability value computed.

The analysis in table 4 compared the mean responses of Furniture Craftsmen and Factory Managers regarding health challenges from Medium Density Fibreboard dust. The result of a z-test showed that the p-value (Sig. 2-tailed) was less than 0.05, leading to the rejection of the null hypothesis. Therefore, there is a significant difference in the mean responses between the two groups, indicating that the factory managers are more aware of the health challenges posed by Medium Density Fibreboard dust than the Furniture Craftsmen.

Ho_2: There is no significant difference in the mean responses of Furniture Craftsmen and furniture factory managers on their level of awareness of the effects of Medium Density Fibreboard dust on personal health.

Table 5: Z-Test analysis of the mean responses of Furniture Craftsmen and furniture factory managers on their level of awareness of the effects of Medium Density Fibreboard dust on personal health.

Group	N	$\bar{x}$	SD	df	Z-value	P-value, Sig. (2-tailed)	Alpha Level	Decision
Furniture Craftsmen	30	2.29	0.82					
				38	-23.28	0.00	0.05	Rejected
Factory Managers	10	4.04	0.80					

*Significant at $p \leq 0.05$.

Key: p-value = probability value computed.

Table 5 presents the results of a z-test conducted to compare the mean responses of Furniture Craftsmen and Factory Managers on their level of awareness of the effects of Medium Density Fibreboard dust on personal health. The p-value (Sig. (2-tailed)) is less than 0.05, indicating that the null hypothesis is rejected. This suggests that there is a significant difference in the mean responses of the two groups, and that Factory Managers are more aware of the effects of Medium Density Fibreboard dust on personal health compared to Furniture Craftsmen.

Ho_3: There is no significant difference in the mean responses of Furniture Craftsmen and furniture factory managers on the safe practices employed to prevent the effects of Medium Density Fibreboard dust on personal health and environment.

Table 6: Z-Test analysis of the mean responses of Furniture Craftsmen and furniture factory managers on the safe practices employed to prevent the effects of Medium Density Fibreboard dust on personal health and environment.

Group	N	$\bar{x}$	SD	df	Z-value	P-value, Sig. (2-tailed)	Alpha Level	Decision
Furniture Craftsmen	30	2.05	0.76					
				38	-2.85	0.00	0.05	Rejected
Factory Managers	10	2.41	0.87					

*Significant at $p \leq 0.05$.

Key: p-value = probability value computed.

The Table 6 analysis compared the mean responses of Furniture Craftsmen and factory Managers on safe practices to prevent the effects of Medium Density Fibreboard dust on personal health and the environment. The result showed that there is a significant difference in their mean responses, with factory managers agreeing more than Furniture Craftsmen on the safe practices to be employed. This conclusion was drawn based on the rejection of the null hypothesis due to a p-value of less than 0.05.

Findings and Discussions

1. The findings indicates that both furniture craftsmen and factory managers acknowledge the health challenges posed by MDF dust, but factory managers are more aware of them. The use of personal protective equipment can reduce exposure to MDF dust and minimize its health effects. Furthermore, a z-test comparing the mean responses of the two groups revealed that there is a significant difference in the level of awareness between factory managers and furniture craftsmen regarding the health challenges of MDF dust.
2. The findings also revealed that the level of awareness of furniture craftsmen and factory managers on the effects of Medium Density Fibreboard dust on their personal health. The mean responses of the craftsmen were lower compared to the managers, and the standard deviation suggests that respondents were consistent in their opinions. The corresponding hypothesis results of a z-test indicates that there is a significant difference in the mean responses of the two groups, with factory managers being more aware of the effects of MDF dust on personal health.
3. The findings also revealed that both furniture craftsmen and the factory managers agreed on safe practices to prevent the harmful effects of Medium Density Fibreboard (MDF) dust on personal health and the environment. They agreed on these safe practices, with relatively small standard deviations indicating similar opinions. However, the corresponding hypothesis showed a significant difference in mean responses between the two groups, with factory managers agreeing more strongly than craftsmen on the safe practices to be employed. This conclusion was drawn based on the rejection of the null hypothesis due to a p-value of less than 0.05.

Conclusion

Based on the findings, it can be concluded that both furniture craftsmen and factory managers acknowledge the health challenges posed by MDF dust, but factory managers are more aware of them. The use of personal protective equipment is recommended to minimize the effects of MDF dust on personal health. The level of awareness and knowledge on the effects of MDF dust on personal health and safe practices to prevent its harmful effects was found to be significantly higher among factory managers compared to furniture craftsmen. Therefore, it is recommended to provide adequate training and education to craftsmen and managers to ensure safe practices in the workplace.

Recommendations

Based on the findings, the following recommendations were made:

1. Increase awareness and education on the health challenges posed by MDF dust among furniture craftsmen. While both groups acknowledge the risks, craftsmen are less aware than factory managers. Providing information and training on personal protective equipment and safe handling practices can help reduce exposure to MDF dust.
2. Provide additional training and education to furniture craftsmen on the personal health effects of MDF dust. The findings indicate that craftsmen have a lower level of awareness than factory managers on this issue. Increased knowledge can help craftsmen take necessary precautions and better protect themselves.

3. Encourage adherence to safe practices for preventing the harmful effects of MDF dust. While both groups agreed on the importance of these practices, factory managers showed stronger agreement than craftsmen. Providing regular reminders and incentives for following safe practices can help reduce the risk of exposure to MDF dust and protect personal health and the environment.

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