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PERCEPTION OF HAZARDS ASSOCIATED WITH COOKING FUEL IN BUILDING INDOOR ENVIRONMENT

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Abstract
This study assessed perception of hazards from cooking fuels in building indoor environment. One hundred questionnaires were randomly administered to selected households in high density settlement of Zaria metropolis with 96% response rate received. Results showed that females are dominant (83%) users of cooking fuels, kerosene (48.1%) and firewood (29.2%) are common types of cooking fuel use by the households. Factors that determine the use of these fuels are cost (28.2%) and types of stove (19.8%). Awareness level of associated hazards is high (62.5%) and frequency of health problems associated with pollutants (39.6%) is alarming. Opening of windows (47.9%) and isolation of cooking area from living area (42.7%) were the common control measures adopted. It is recommended that public enlightenment on health issues relating to indoor air pollution should be emphasized, as well as implementing codes for control of pollution in the indoor environment.

Keywords: perception, households, cooking fuel, hazard, indoor environment

1. Introduction
Indoor air pollutants have been rated as the highest killer compared to malaria and poor sanitation in developing countries [1]. It is estimated to have claimed 1.6 million lives annually, mainly children and women [2], who spend most part of their time (80 – 85%) indoors preparing family meals [3]. Most households in the developing countries rely mainly on traditional fuels such as firewood, charcoal, bagasse (sugar cane waste), animal and vegetable wastes [4]. These fuels are responsible for respiratory infections in children under 5 years of age and also cause other ailments such as Chronic Obstructive Pulmonary Disease (COPD), lung cancer, asthma, tuberculosis, heart disease, irritation of the eyes, nose and throat, headaches, dizziness and fatigue [1][6][7].Gas, electricity, solar energy etc. are some prominent and modern sources of energy for household use which are not common in most developing countries due to cost, culture, accessibility and other challenges [8].
Indoor Air Quality (IAQ) is a significant factor that affects human health and productivity [9]. Most human exposure to pollutants occurs indoors [10], yet people have docile attitudes towards the quality of the indoor environment [11]. These attitudes might be due to poor knowledge of the indoor and the environment surrounding it [12].
This study aims at assessing the perception and awareness level of building occupants on poor indoor air quality associated with cooking fuels in buildings with a view to enlightening households on the need to improve the quality of the indoor environment.

2. Methodology
Review of relevant literatures were carried out in the subject area. This was followed by the administration of a structured questionnaire to one hundred (100) households randomly selected in Zaria metropolis of Kaduna State. The study was cross sectional descriptive in nature carried out between May and July 2012. Some of the issues the questionnaire seek to know included household fuel type, factors that determine their use, cooking characteristics, awareness of associated pollutants, level of exposure to pollutants and control measures. Checklist was also used to assess the ventilation provided in the cooking areas and the stove location. Data obtained from the survey were analysed using Statistical Package for Social Science (SPSS) version 16. The results are presented in tabular form.

3. Results and Discussion
One hundred (100) questionnaires were administered to households in Zaria metropolis and 96 were retrieved giving a response rate of 96%.

Table 1: Respondents socio-demographic characteristics (N= 96)

Variable	Frequency	Percentage
Sex		
Male	16	17.0
Female	80	83.0
Age group (in years)		
<20	7	7.3
21- 30	31	32.3
31- 40	16	16.7
>40	42	43.8
Marital status		
Married	55	59.3
Single	37	38.5
Widow	4	4.2
Level of education		
No formal education	6	6.3
Primary	3	3.1
Secondary	18	18.8
Tertiary	69	71.9
Occupation		
Business	36	37.5
Civil service	45	46.9
Others	15	15.6
Family size		
< 4	24	25.0
4- 5	24	25.0
6- 7	30	31.3
8- 9	10	10.4
>9	8	8.3
*Monthly income(in ₦ *)*		
5,000	6	6.3
5000- 20,000	19	19.8
20001- 50000	27	28.1
>50000	44	45.8

*1$= ₦160

Table 1 shows the respondents' profile. It can be observed that majority of the respondents with the highest frequency of 83.0% are females. This result is not unconnected with the fact that in most African culture, female are the dominant gender in household activities. This could also be the reason why women are more exposed to indoor air pollution than male as observed in similar studies [2][3].Most of the respondents' ages were above 21 years. This shows that the cooking activities are carried out by adults. The table also shows that 59.3% are married, 71.9% have attended tertiary institution, 46.9% are civil servants and 37.5% business owners. These show that most respondents are well educated and have source of income to determine the choice of their household fuel type.

The same table also shows that majority of the households with the highest frequency of 31.3% are made up of 6 members in a family. This is a clear picture of African setup made of at least six and above members in a home and their monthly income is above ₦50,000 (with the highest frequency of 45.8%). These results show that the family can at least afford the cheapest form of clean energy [13].

Table 2: Fuel type and factors that determine its use (N= 96)

Variable	Frequency	Percentage
Fuel type		
Firewood	28	29.2
Charcoal	4	4.2
Kerosene	47	48.1
Gas	15	15.6
Electricity	2	2.1
Types of stove used by Households		
Kerosene	51	53.1
Electric	8	8.3
Gas cooker	16	16.7
Mud oven	11	11.5
Others	10	10.4
Factors that determine the use of fuel type		
Cost of fuel	27	28.1
Available stove	19	19.8
Accessibility to fuel	10	10.4
Characteristics of stove	6	6.3
Cooking practices	9	9.4
Cultural preferences	6	6.3
Potential health impacts	14	14.6
Taste of food	5	5.2

Table 2 shows that the common type of cooking fuels use by majority of the households is kerosene with highest frequency of 48.1%, while 29.2% and 15.7% use firewood and gas respectively. This could be associated with the availability and to some extent affordability of kerosene as shown in Also majority of the respondents (53.1%) use kerosene stove, while the least frequency of 8.3% use electric stove. The use of kerosene dominates households' fuel usage while the use of electricity is low; which could be connected to the epileptic nature of power supply in the country and its high cost [14]. A number of the households {28 (29.2%)} use firewood which could be alarming because it is associated with health risk. Table 2 also shows the factors that determine the choice of household cooking fuel, 27(28.1%) with the highest frequency ascertained that cost of fuel is a major factor considered, while 19(19.8%) ascertained that the available stove type determine their choice of fuel, 10(10.4%) ascertained that accessibility to fuel is a factor. Others are technical characteristics of the stove and cultural preference (6.3%), cooking practices (9.4%) and health impacts associated with the fuel (14.6%). However, the least frequency of 5.2% chooses the type of fuel based on the taste of food prepared by it. It is evident that cost of fuel is among the factors that determine the choice of fuel for cooking in households.

Table 3: Cooking and cooking space characteristics (N=96)

Variable	Frequency	Percentage
Frequency of cooking per day		
1	3	3.1
2	29	30.2
3	58	60.4
4	5	5.2
>4	1	1.0
Daily No of hours spent to cook (in hrs)		
< 2	36	37.5
2- 3	44	45.8
4- 5	9	9.4
>5	13	7.3
Type of cooking area		
Kitchen	70	72.9
Living area	4	4.2
Outdoors	21	21.9
Others	1	1.0
Ventilation type provided		
Open window	72	75.0
Open door only	14	14.3
Eave space	10	10.4
Floor area for the cooking space(m^2)		
< 2	8	8.3
2- 3	25	26.0
3.1- 4	29	30.2
4.1- 5	24	5.0
>5	10	10.4
Window area available in the cooking area (mm)		
1500 × 1500	26	27.0
1200 × 1200	27	28.0
900 × 900	27	28.0
600 × 600	12	12.0
Others	5	5.0

From Table 3 above, majority of the respondent (60.4%) cook three times a day and spend between 2 – 3hours (45.9%) preparing the meals. It is therefore, evident that the respondents are exposed to air pollutants from cooking fuel for a long time. This is worrisome as ill-health is associated with exposure to long time indoor air pollutants [2][15][16].

Also cooking space characteristics shows that kitchen was used by most households with frequency of 70.0%, while 21.9% use outdoors and 4.2% use the living area. Also from the table, majority of the respondent 75.0% use open windows ventilation, while 10.4% use eave of the building. The highest frequency of 91.7% has a floor area greater than $2m^2$ and 88.0% with window size of $0.81m^2$ and above. It is evident that there is adequate provision for ventilation in most of the households' cooking spaces.

Table 4: Awareness of indoor air pollution and perceived level of pollutants emitted into the house (N= 96)

Variable	Frequency	Percentage
Awareness of indoor air pollution		
Yes	60	62.5
No	36	37.5
Awareness of pollutants from cooking fuel		
Yes	67	70.0
No	29	30.0
Perceived level of indoor air pollution		
High	10	10.4
Moderate	9	9.4
Low	32	33.3
Not significant	45	46.9

Table 4 shows the level of awareness of indoor air pollutant by the respondents. It can be deduced that majority of the respondents are quite aware of indoor air pollution (62.5%) and are also aware that cooking fuels emit pollutants (70%). It is evident that there is high awareness of pollutants emission from cooking fuels in the indoor environment as also observed in similar study [17].

Majority of the households with the highest frequency of 46.9% perceive insignificant level of pollutants in the indoor, however, 10.4% perceived high pollutants emission from cooking fuel. It is established that there is insignificant pollutants emission in the households, however, the presence of the pollutants indoor necessitate the adoption of strategies to reduce this since it is health related problems (Table 4).

From Table 5, majority (77%) of the respondents are aware that pollutants from cooking fuel are detrimental to health, only 23% are not aware. Respondents who had ill-health challenges as result of pollution was 39.6%, however 60.4% had no health problem. The highest symptom observed was eye irritations with the frequency of 65.5%. Only 2.6% have been hospitalized due to pollution associated with cooking fuels. It is therefore evident that the effect of the pollutants in the study area is irritation of the eye which was also observed in similar study [18].

Table 5: Perceived health related issues associated with indoor pollutants from cooking fuel

Variable	Frequency	Percentage
Awareness of indoor air pollutants from cooking		

Variable	Frequency	Percentage
fuel detrimental to health (n= 96)		
Yes	74	77.0
No	22	23.0
Had ill-health as a result of pollutants from cooking fuel (N=96)		
Yes	38	39.6
No	58	60.4
Symptom(s) experienced as a result of pollutants from cooking fuel(N=55)		
Irritation of the eyes	36	65.5
Fatigue	3	5.5
Headache	2	3.6
Sneezing and coughing	14	25.5
Hospitalized as a result of pollutants from cooking fuel (N=38)		
Yes	1	2.6
No	37	97.4

Figure 1, the factors that contribute to indoor air pollution from cooking fuel were assessed. It was observed that 32.3% perceived fuel type contributes to indoor air pollution, while 28.1% attributed it to poor ventilation in the indoor environment. However, Table 3 shows that there is adequate provision of windows for ventilation. It is therefore, evident that fuel type is a factor that contributes to the indoor air pollution which agrees with the findings [16].

Figure 2 shows the different control measures adopted by the respondents for indoor air pollution. Majority with frequency of 47.9% adopt opening of windows to expel pollutants from the building, while 42.7% isolate the cooking space from the living area. Figure 3 shows respondents suggestions on measures that can be taken to control indoor air pollution from cooking fuel. Majority with frequency of 63.5% suggest public enlightenment as a means to reduce the problem, while 16.7% suggest implementation of code for indoor environmental pollution control. From the study, majority of the respondents perceived that public enlightenment will enhance households' knowledge on the control measures of indoor air pollutants.

4. Conclusion

Kerosene stove has been associated with most cooking activities in which the household's monthly income is above ₦50,000. The use of this fuel has been associated with its affordability and availability. The use of fuel exposes the households to air pollutants from cooking fuels for long periods of time resulting to ill-health associated with long time indoor pollutants exposures. There is high awareness level of indoor air pollutants associated with cooking fuel in the building indoor environment, however most perceived insignificant pollutants concentration from the kerosene stove. Most households adopt the use of adequate windows opening for ventilation to reduce pollutants concentration. Public enlightenment has been suggested as a means to educate users on the proper way to use cooking fuel in the indoor environment.

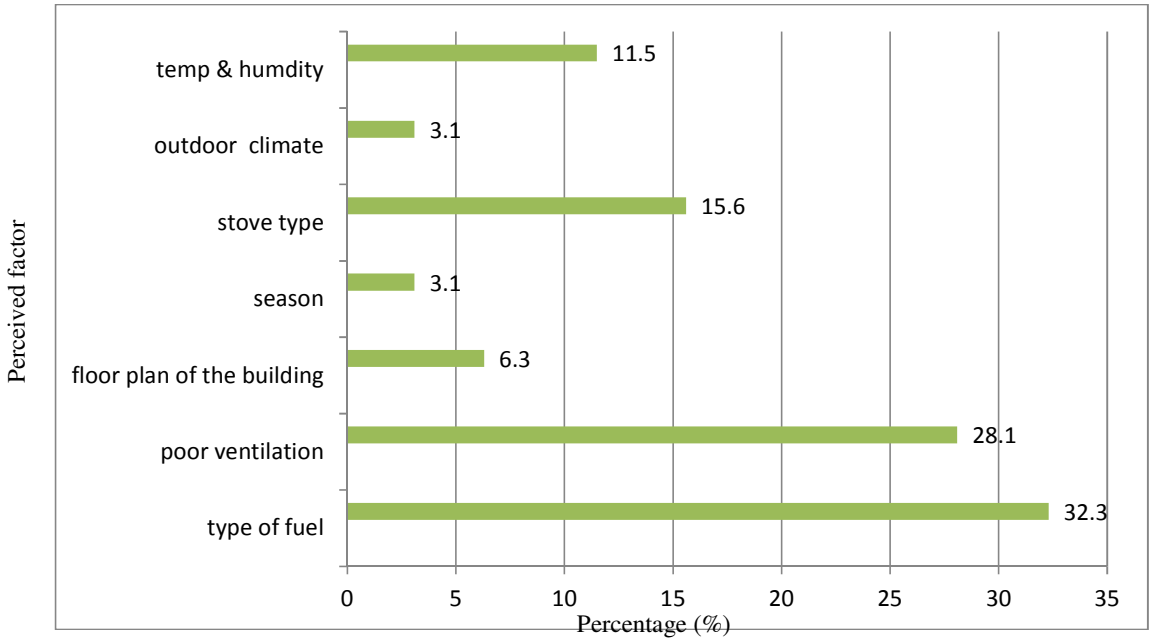


Figure 1: Perceived factors that contribute to indoor pollution from cooking fuel (N=96)

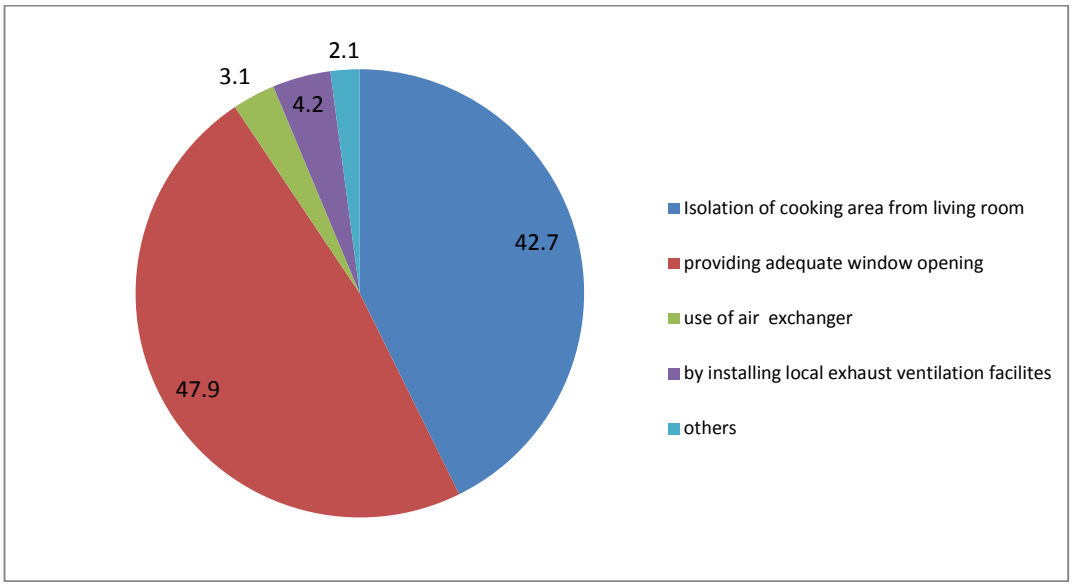
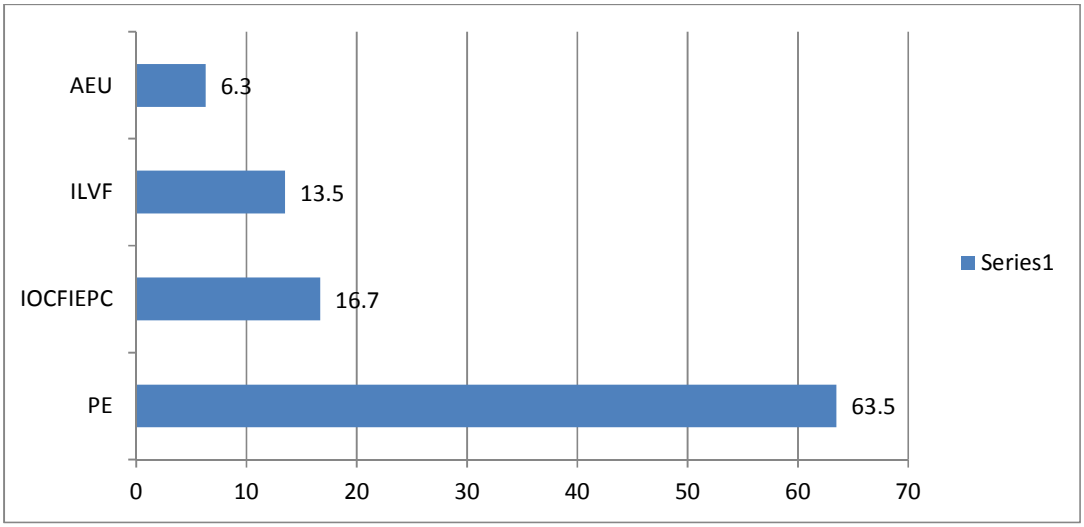


Figure 2: Control measures adopted for indoor air pollution (N= 96)



KEY
AEU = Air Exchanger Use ILVF = Installing Local Ventilation Facilities PE = Public Enlightenment
IOCFIEPC = Implementation of Code for Indoor Environmental Pollution Control

Figure 3: Other perceived control measures (N= 96)

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