

KNOWLEDGE, ATTITUDE AND PRACTICE OF SAFETY MEASURES AMONG COOKING GAS REFILL ATTENDANTS IN ZARIA METROPOLIS, KADUNA STATE, NIGERIA

Joshua I. A.^{1*}, Muhammed U.², Sufiyan M. B.³, Olaniyan A. F.⁴, Sabitu K.³, Ibrahim M. S.³, Olasinde A. A.³, Igboanusi C. J. C.⁵ and Usman N. O.¹

¹Department of Community Medicine, College of Medicine, Kaduna State University, Kaduna State, Nigeria

²Department of Surgery, Federal Medical Centre, Nguru, Yobe State, Nigeria

³Department of Community Medicine, Faculty of Clinical Sciences, College of Health Sciences, Ahmadu Bello University, Zaria, Nigeria

⁴Department of Obstetrics and Gynaecology, Ahmadu Bello University Teaching Hospital, Zaria, Nigeria

⁵Department of Public Health, 2 Division Medical Services & Hospital, Headquarters 2 Division, Nigerian Army, Adekunle Fajuyi Cantonment, Ibadan, Nigeria

*Corresponding Author's Email Address: dristifanus@yahoo.com

Phone: +2348037039752

ABSTRACT

Background: Cooking gas refill attendants play important role in the use of gas in Zaria. The aim of this study was to assess the knowledge, attitude and safety measure practices among cooking gas refill attendants in Zaria metropolis, Kaduna State, Nigeria. A cross sectional study was conducted in January, 2019 among cooking gas refill attendants using structured interviewer-administered questionnaire and checklist. It was a whole-population study of 121 participants. The data was collected using Open Data Kit (ODK) software version 1.21.1 installed in an android device and analyzed using SPSS version 25.0. The results were summarized and presented in tables and charts; p value was set at < 0.05 for statistical significance. Majority (79.6%) of the respondents were within the productive age group of 25 to 44 years with median age 36 years, married (57.9%) and more than half (52.1%) of the respondents had secondary education and all respondents were males. The overall scores for knowledge, attitudes and safety practices were 81.0%, 90.1% and 75.2% respectively but with various deficiencies. Those that attended training were 78.0%. Finding from the checklist showed that 5.8% of the inspected fire extinguishers were expired. The respondents' knowledge, attitude and safety measures practices were associated with level of education, age and ethnicity. Majority of the gas refill attendants had good knowledge, attitude and safety measure practice, however, with some deficiencies. There is need for training and supervision to ensure use of personal protective equipment and replacement of the expired fire extinguishers.

Keywords: Cooking gas, Knowledge, Refill Attendants, Safety measures

INTRODUCTION

Liquefied petroleum gas (LPG)/clean cooking fuel, is a commercial mixture which mainly consists of butane and propane, with small amounts of lighter and heavier fractions such as ethane and pentane that is highly flammable, colourless which readily evaporates into a gas. For safety purposes, it contains a sulphur-based odorizing agent with a distinctive, persistent and unpleasant smell to allow leaks to be more easily detected (Sirdah *et al.*, 2013; Seven *et al.*, 2017).

The use of LPG is on the increase globally (Bizzo *et al.*, 2004; Richendo *et al.*, 2006). Hundreds of millions of people throughout the world rely on LPG for cooking, because of its high heat content, consistent temperature, portability, cleaner energy, convenience and safety, among others. It is replacing the use of solid fuels (coal, fire woods) and kerosene the traditional cooking fuels associated with deleterious health, economic and environmental consequences (Bizzo *et al.*, 2004; Richendo *et al.*, 2006). Achieving Sustainable Development Goal 7 (SDG7), i.e. ensuring access to affordable, reliable, sustainable, and modern energy for all by 2030, will therefore, require a massive scale-up in the deployment and adoption of clean and affordable cooking solutions (Richendo *et al.*, 2006).

Cooking gas refilling is a problem in developing countries such as Nigeria. In Zaria, establishment of cooking gas refill stations is on the increase (Gatawa & Abdullahi, 2017). However, gas refill and use are not without problems, and these Problems include explosion, burns, extensive cold injury and necrosis, arrhythmias, asphyxia and sudden death (Paliwal *et al.*, 2014; Kapi *et al.*, 2017; Jin *et al.*, 2018). Gas refill attendants are important group of workers. Their occupational hazards could be classified into chemical, physical, biological and psychological, among others. These are related to the high flammability and Boiling Liquid Expanding Vapour Explosions (BLEVE) phenomenon of the products. The principal potential hazards with LPG are explosion and fire (Rocha *et al.*, 2014; WLPGA, 2018) and it may cause various clinical manifestations after inhalation, depending on the duration, quantity of substance inhaled and its concentration (Seven *et al.*, 2017). The incidence of LPG-related burns has increased over recent years (Jin *et al.*, 2018).

It is therefore, very important to assess gas refill attendants' knowledge, attitude and practice of safety measures in order to prevent the high morbidity and mortality associated with gas accidents. There are evidences that some gas station attendants do not use personal protective equipment (PPE), which is one of the safety measures against gaseous hazardous environment (Ghofranicpour *et al.*, 2009; Rocha *et al.*, 2014). In Nigeria, low level of safety knowledge and practice has contributed to accidents among LPG workers (World Bank, 2004).

The promotion of safety among LPG workers is one of the key aims of the World LPG Association. Safety measures are

deliberate practical actions taken by the senior managers of organisations to protect, maintain and promote the health; safety and wellbeing of their workforce both within and outside of the work environment (Ansah, 2005). The 3Es of safety are education, enforcement and engineering. Use of personal protective equipment (PPE) by the workers is very important; and they refer to equipment or devices worn to minimize exposure to a variety of hazards. The availability of boots, apron, gloves, masks, goggles, earplugs, uniforms in gas stations are required to promote constant use of such devices. Other safety measures include knowledge of fire triangle, use of fire extinguisher, cylinder safety, workers and workplace related safety (Rocha *et al.*, 2014; WLPGA, 2018).

In view of the increasing importance of gas refill attendants in Zaria metropolis and the paucity of data on their knowledge, attitude and practice of safety measures this study was conducted. The information will be important to policy makers for the design of effective preventive and safety measures in order to reduce the hazards associated with gas refill, and will also serve as a baseline information in the study area.

MATERIALS AND METHODS

Study Area

Zaria metropolis is within Kaduna State in the North western Nigeria. It consists of two Local Government Areas (LGAs) - Zaria and Sabon Gari LGAs. Zaria is located between longitude 7° and latitude 11° North to East. Zaria metropolis has a projected population of 719,000 (NPC, 2012) and it is cosmopolitan in nature, consisting of various ethnic groups but majority Hausas.

There were 5 gas stations and 45 retail shops in Zaria metropolis. The 5 gas stations had total of 25 refill attendants and the 45 retail shops had a total of 96 refill attendants. The 5 stations and 90 retail shops were located in Sabon Gari LGA while the remaining 6 refill shops were in Zaria LGA.

There are 102 health facilities (41 in Zaria and 61 in Sabon Gari) with a number of tertiary educational and research institutions- Ahmadu Bello University (ABU), Nigerian College of Aviation Technology (NCAT), Nigerian Institute of Leather and Research Technology (NILEST), National Animal Production Research Institute (NAPRI), Federal College of Education (FCE), Nuhu Bamali Polytechnic, Nigerian Institute of Transport Technology (NITT), Ameer Shehu Idris College.

Study Design

A cross sectional study was conducted in January 2019.

Study Population

This was made up of gas refill attendants working for at least 3 months in the gas stations or retail shops. Only those directly involved with refilling of cooking gas cylinders were included.

Sample size

It was a whole population study consisting of 121 attendants that met the inclusion criteria.

A list of all the gas refill attendants was compiled totally 121. The 5 stations had average of 5, making a total of 25, while 39 of the retail shops had average of 2 attendants totally 78 and the remaining 6 retail shops had average of 3 totally 18 attendants. All the 121 attendants met the inclusion criteria.

Data collection tools

Data was collected with a structured interviewer-administered questionnaire on an open data kit (ODK) version 1.21.1 and an observation checklist.

The questionnaire had 4 sections comprising of- A: socio-demographic characteristics, B: knowledge of LPG and safety measure practice, C: attitude of the attendants towards safety measures, D: practice of safety measures and an observation checklist on practice of safety measures.

The information was collected by 5 trained research assistants in 2 days and the language used was English. The research assistants were resident doctors in the department of Community Medicine, Ahmadu Bello University, Zaria and they were trained on the objective of the study and use of ODK to collect data and the checklist for uniformity.

Data analysis

The data collected in the ODK were exported into Statistical Package for Social Science (SPSS) version 25.0 and analyzed. Summary statistics were generated and results presented in tables and charts. Chi square test was conducted to test for associations between categorical variables in contingency table with p value set at <0.05.

The knowledge, attitude and practice of safety measures were scored using the various indices as adapted (Ogboghodo *et al.*, 2016). The knowledge had a total of 11 questions, those that scored ≤5 correct responses were graded as poor and those with ≥6 correct responses were graded as good). The attitude had a total of 5 questions and those that scored ≤2 correct responses were graded as negative and those with ≥3 correct responses were graded as positive. The practice of safety measures had a total of 9 questions and those that scored ≤4 correct responses were graded as poor and those with ≥5 correct responses as good.

Ethical consideration

The permission to conduct the study was sought and obtained from Department of Community Medicine of Ahmadu Bello University, Zaria, in addition to the one obtained from the owners of the gas stations and gas retail shops. Verbal informed consent was sought from the gas refill attendants after full explanation about the study and assurances about their confidentiality.

RESULTS

A total of 121 questionnaires were administered among the respondents and all were retrieved, giving a 100.0% response rate. Majority (79.3%) of the respondents were within the age bracket of 25 to 44 years with median age of 36 years, more than half (52.1%) had secondary education, had training on safety and all 121 were males (Table 1). Knowledge of the respondents on various indices was above average except for control programmes (40.5%), safety operating manual (39.7%) and correct components of fire triangle (45.0%) (Table 2). The commonest source of information was training (Figure 1). The various indices for the attitude ranged between 82.0% and 93.0% except for checking expiry date of cylinders (8.3%) (Table 3). Practice of safety measure among the respondents ranged between 66.0% and 90.9%, except for the use of operation manual (23.1%), checking of expiry date of cylinders (33.0%) and use of safety manual (30.0%) (Table 4). One hundred and

fourteen (94.2%) of the fire extinguishers were not expired. Eighty-one percent of the respondents had good knowledge score of LPG, safety measures, problems associated with its use among others; 109 (90.0%) had positive attitude towards safety measures associated with LPG and 91 (75.2%) had good practice score (Table 5). Tables 6 and 7 showed the statistically significant relationships between the socio-demographic characteristics and outcome variables.

DISCUSSION

Majority of the respondents were within the productive age group with median age of 36 years and married similar to studies in Brazil and Pakistan (Rocha *et al.*, 2014; Zeb *et al.*, 2017). These are young people that have stamina to do this kind of job that may require lifting and carrying of gas cylinders.

In addition, all the respondents were male, probably because the job is perceived to be hazardous; therefore females shy away from it. Lack of employment in the country may be responsible for the high proportion of respondents with tertiary education as refill attendants in the gas stations/retail shops.

Most of the respondents had training on safety as they work in the gas stations/retail shops. These findings agreed with the result of the study in Lagos with 76.1% of respondents trained on safety (Adeobola, 2014). In this study, about one-third of the respondents had information from the training they had, and 30% from their business partners and 27% from their supervisors, among others. This might be responsible for the high level of knowledge on safety measures by the attendants but with few areas of deficiencies in knowledge on safety measure control program, safety operating manual and correct components of fire triangle. Because the job is perceived to be very hazardous, most workers will go extra miles to get knowledge, skills and possibly training before starting the job. In the same vein, the owners of such businesses will take training of new staff very seriously. Some results of this study are slightly different from the study in Lagos (Adeobola, 2014) which showed better scores for adequate water supply (89.4%), safety measures control programmes (68.3%) and safety operating manual (58.5%) (Adeobola, 2014). This could be related to the higher level of education among the Lagos respondents. Training of workers is important in order to prevent or minimize the risk of injury to them and also damage of cylinders.

The overall attitude score was positive (90.1%) but 91.7% of the respondents had poor attitude toward checking the expiry dates of customer's cylinders. This may be because of less importance they attached to that and the time they will waste in doing that especially when there are many customers waiting to refill their cylinders. The high positive attitude towards safety measure in this study is better than that in a study carried out in Pakistan¹⁶ showing (53.5%) of their respondents demonstrated good attitude towards occupational safety measures (Zeb *et al.*, 2017). But slightly lower compared with another study conducted in Lagos, Nigeria which shows that (85.2%) of their respondents had good overall attitude toward safety measures while (14.8%) showed poor attitude (Adeobola, 2014). This could be because the Lagos study was conducted some few years back when little was done by the relevant stakeholders on information dissemination.

The overall practice of safety measure was high but with deficiencies in the practice of use of operational and safety manuals and checking of expiry dates of cylinders. This could

increase vulnerability to occupational accidents. Cylinder valve is used both for re-filling of cylinder and use of gas cooker in home, therefore, its condition and performance are crucial for safety (WLPGA, 2018).

The use of PPEs in this study is slightly higher compared with a study in Pakistan with a figure of 69.3% (Zeb *et al.*, 2017) and much higher in relation to a study done in Iran in which only 29 - 31% of them used PPE (Ghofranicpour *et al.*, 2009). This could be due to safety training received and educational status of the respondents in this study.

Majority (80.1%) of the respondents could operate the fire extinguishers. This is an important preparedness against any fire outbreak in the work place. It was also observed that majority of the fire extinguishers were not expired. This could be because supervisors from fire service do visit gas working environment frequently to check for expiry dates, service their fire extinguishers and give health education. The small proportion of fire extinguishers that were expired could give a false sense of fire preparedness and safety in those cooking gas refill stations; and in an event of fire outbreak it will be difficult to put off the fire resulting in loss of lives and properties.

There were statistically significant relationships between the respondents' knowledge and age ($p < 0.019$) and level of education ($p < 0.004$). Attitude was found to be associated with level of education ($p < 0.002$) and practice showed statistical significance with ethnicity ($p < 0.029$) of the respondents.

The public health implication of this research is important in the area of government policies, programmes and regulation, among others. Cooking gas explosion in Nigeria is a recurring decimal. The explosion that took place in Kaduna 4th January 2020 claimed the lives of The Chairman/Director General Nigeria Atomic Energy Commission and seven others and properties worth 16 million naira (\$1= 360 naira) were lost.

These have generated discussion by stakeholders for the need to increase awareness and education of users of LPG, owners of LPG stations/shops, refill attendants by the relevant government agencies such as Department of Petroleum resources and Standard Organisation (SON) for strict regulation in the establishment of gas plants/stations or retail shops in residential or near residential areas. In addition, use of newer technologies such as composite cylinders, advanced cooking equipment (infrared burners, double spindle valve system, reinforced hose), cylinder tracking system, cylinder sensors, smart metering (pay-as-you-cook model) and LPG leak detection system to improve safety and reduce accidents associated with the sale and use of LPG will reduce the preventable injuries, deaths and loss of properties from LPG accidents.

Conclusion

The study found that majority of the respondents had good knowledge, positive attitude and good practice of safety measures, however with some deficiencies. There was a statistically significant relationship between some of the respondents' socio-demographic characteristics (age, level of education and ethnicity) and knowledge, attitude and practice of safety measures. The recommendations based on the findings include-

1. Education of the workers by the owners of the stations/shops, fire service and other relevant stakeholders to address the identified deficiencies in knowledge and

- practice.
2. Proper supervision of the workers to ensure compliance with the use of personnel protective equipment by those not using them.
 3. Training of the workers that did not received training and those that do not know how to use fire extinguisher and re-training of those that have had training before by the fire service staff or other relevant stakeholders.
 4. Replacement of the expired fire extinguishers by the owners of the gas stations/shops for improved fire safety.

Table 1: Socio-demographic characteristics of gas refill attendants in Zaria metropolis, Kaduna State (n=121)

Characteristics	Frequency (%)
Age (in years)	
15-24	21 (17.4)
25-34	70 (57.8)
35-44	26 (21.5)
45-54	4 (3.3)
Sex	
Male	121 (100.0)
Marital status	
Single	51 (42.1)
Married	70 (57.9)
Ethnic group	
Hausa	53 (43.8)
Ibo	39 (32.2)
Yoruba	19 (15.7)
Fulani	10 (8.3)
Religion	
Islam	72 (59.5)
Christianity	49 (40.5)
Level of education	
No formal education	9 (7.4)
Primary	10 (8.3)
Secondary	63 (52.1)
Tertiary	39 (32.2)
Training on safety	
Yes	94 (77.7)
No	27 (22.3)

Table 2: Knowledge of the various safety measures among gas refill attendants in Zaria metropolis, Kaduna State (n=121)

Variable	Frequency (%)
Control program	49 (40.5)
Safety operating manual	48 (39.7)
Gas cylinder valve	96 (79.3)
Use of PPEs	105 (86.8)
No smoking measure	107 (88.4)
Sand box	88 (72.7)
Fire triangle	73 (60.3)
Correct components of fire triangle	33 (27.3)
Hazards associated with the occupation	111 (91.7)
Use of fire extinguisher	108 (89.3)
Importance of adequate water supply	75 (62.0)

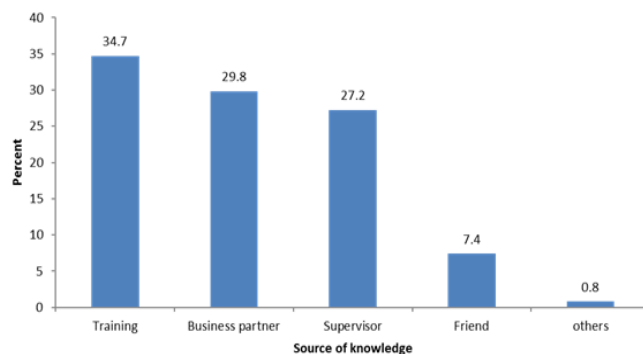


Figure 1: Sources of information for cooking gas refill attendants in Zaria metropolis, Kaduna State

Table 3: Attitude towards safety measures among gas refill attendants in Zaria metropolis, Kaduna State (n=121)

Variable	Frequency (%)
Recommending use of safety measures to others	112 (92.6)
Observing no smoking	106 (87.6)
Giving safety tips to customers	99 (81.8)
Checking expiry dates of cylinders	10 (8.3)
Checking expiry dates of fire extinguisher	112 (92.6)

Table 4: Practice of safety measures by the gas refill attendants in Zaria metropolis, Kaduna State (n=121)

Variable	Frequency (%)
Use of operation manual	28 (23.1)
Gas cylinder valve check	80 (66.1)
Use of PPEs	92 (76.0)
No smoking	95 (78.5)
Attending regular safety training	94 (77.7)
Checking the expiry date of cylinder	40 (33.0)
Use of safety manual	36 (29.8)
Use of fire extinguisher	97 (80.2)
Giving safety tips to customers	110 (90.9)

Table 5: Overall scores and grading of knowledge, attitude and practice of safety measures among gas refill attendants in Zaria metropolis, Kaduna State (n=121)

Variable	Frequency (%)
Knowledge	
Good	98 (81.0)
Poor	23 (19.0)
Attitude	
Positive	109 (90.1)
Negative	12 (9.9)
Practice	
Good	91 (75.2)
Poor	30 (24.8)

Table 6: Relationships between knowledge, attitude versus educational status of gas refill attendants in Zaria metropolis, Kaduna State (n=121)

Variable	Educational status				Test statistic Chi square P value
	No formal Frequency (%)	Primary Frequency (%)	Secondary Frequency (%)	Tertiary Frequency (%)	
Knowledge					
Good	4 (4.1)	7 (7.1)	50 (51.0)	37 (3.8)	13.582
Poor	5 (21.7)	3 (13.0)	13 (56.5)	2 (8.7)	<0.004
Attitude					
Positive	5 (4.6)	8 (7.3)	59 (54.1)	37 (33.9)	15.047
Negative	4 (33.3)	2 (16.7)	4 (33.3)	2 (16.7)	<0.002

Table 7: Relationship between knowledge versus age and practice versus ethnicity (n=121)

Variable	Age group (in years)				Test statistic Chi square P value
	15-24 Frequency (%)	25-34 Frequency (%)	35-44 Frequency (%)	45-54 Frequency (%)	
Knowledge					
Good	12 (12.2)	57 (58.2)	26 (26.5)	3 (3.1)	9.935
Poor	8 (34.8)	13 (56.5)	1 (4.3)	1 (4.3)	<0.019
	Ethnic group				
	Hausa Frequency (%)	Ibo Frequency (%)	Yoruba Frequency (%)	Fulani Frequency (%)	
Practice					
Good	33 (36.3)	32 (35.2)	17 (18.7)	9 (9.9)	8.989
Poor	20 (66.7)	7 (23.3)	2 (6.7)	1 (3.3)	<0.029

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