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Factors affecting workers' delivery of good hygienic and sanitary operations in slaughterhouses in north-central Nigeria

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Abstract

This survey assesses the levels of knowledge and preventive practices of workers on the hygienic and sanitary operations in slaughterhouses in Niger State, north-central Nigeria. A cross sectional survey was conducted on 385 workers aged 20 years and above between January 2013 and April 2013 using structured questionnaires and checklist to assess their knowledge and preventive practices about slaughterhouse operations. Majority (94.0%) of the respondents were males and most (69.6%) were married. Majority (34.3%) of the workers were in the age group 30–39 years. The mean age of the workers was 40.8±10.7 years. One in five (19.2%) were illiterates. Majority of the respondents 95.6% and 96.4% for meat hygiene and sanitation respectively did not have any previous training. About two-third of the workers (74.5%) had poor knowledge about good slaughterhouse operations and more than two third (86.2%) engage in poor preventive practices. The slaughterhouse workers in the age group 60-69 years were less likely [OR 0.1345; 95% CI 0.0397, 0.4553)] to have poor knowledge of the operations than those in the 20-29 age group. The workers with secondary and tertiary education were less likely [OR 0.3557; 95% CI (0.1706, 0.7418) and OR 0.1259; 95% CI (0.0556, 0.2851) respectively] to have poor knowledge than those without formal education. Workers who know correct definition of slaughterhouse hygiene were less likely [OR 0.3125; 95% CI (0.1862, 0.5244)] to demonstrate poor preventive practices, and those who are aware of the effects of improper operations on public and environmental health were more likely [OR 6.587; 95% CI (4.094, 10.6)] to demonstrate satisfactory preventive practices. This survey indicates the need to sensitize and organize trainings for slaughterhouse workers to improve their knowledge of standard slaughterhouse operations to produce wholesome meat and safeguard public and environmental health.

Keywords: Abattoir workers, knowledge, operations, preventive practices, slaughterhouse, Nigeria
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Introduction

A slaughterhouse is a special facility designed and licensed for receiving, holding, slaughtering and inspecting meat animals and meat products before release for public consumption (Alonge, 2005). Proper slaughterhouse operations involve examination of live animal before slaughter (ante–mortem examination); slaughtering, evisceration, carcass's inspection (post–mortem inspection) and waste disposal. All these are crucial to the delivery of wholesome meat and surveillance of animal diseases, especially those of public health importance (FAO, 1992; Nwanta *et al*., 2008). In slaughterhouse practices, basic operating and environmental conditions of good sanitary and good hygiene practices as well as standard operating procedures are needed for the production of safe meat (Declan *et al*., 2004). The continuous failure to adhere to Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP) in slaughterhouse processing procedures in developing countries, especially in Nigeria, has resulted in meat contamination and poor waste disposal, with

consequent effects on the environmental and human health (Akinro *et al*., 2009).

Generally, government authorities in Nigeria, especially those at the local level constitutionally saddled with management of slaughterhouses have neglected this responsibility, resulting in deterioration of their sanitary conditions, improper meat inspection, poor knowledge of meat hygiene processing, poor environmental hygiene and compromise of public health (Nwanta *et al*., 2008). In most slaughterhouses, slaughtering and processing facilities are not available, no good sewage or waste disposal systems, inadequate clean water supplies and refrigeration (Adeyemo, 2002; Lawan *et al*., 2013). Further, the paucity of records on the epidemiology of slaughterhouse operations, vis-à-vis workers' operational knowledge and compliance with the preventive practices in most Nigerian slaughterhouses is also an impediment to good slaughterhouse operations and has hindered planning and policy making on hygienic measures and sanitary practices for control strategies of slaughterhouse-related health problems. This has also undermined forecasting and stimulation of public-private-partnership interventions on slaughtered animal wastes management in Nigeria. This survey, therefore, was aimed at assessing the level of knowledge and preventive measures of slaughterhouse workers on the hygienic and sanitary operations in some slaughterhouses in Niger State, north-central Nigeria. Information generated from this study will serve as indicator for training and sensitization of these workers for better wholesome meat delivery to the public.

Materials and Methods

Study area

Niger State is located in the North-central geo-political zone of Nigeria with human population of about 4.2 million people (NPC, 2006) and slaughterhouse workers population (butchers, meat sellers and cleaners) of about 4,516 people (MLFD, 2013). The state has estimated cattle population of about 2.4 million, 1.7 million sheep and 2.3 million goats (MLFD, 2013). It experiences two distinct seasons, rainy season which spans between April and October, and dry season between November and October; with mean annual rainfall of about 1600mm and average lowest and highest temperatures of about 27^{o}C and 39^{o}C respectfully. The main slaughterhouses in the state are located in the major cities of Minna, Bida, Kontagora, Suleja and New-Bussa with waypoint coordinates of N09.646554^{o}, E006.54436^{o}; N09.0857^{o}, E006.02027^{o}; N10.41057^{o}, E005.46677^{o}; N09.13716^{o}, E007.20159^{o}; and N09.87717^{o}, E004.51302^{o} respectively. Cattle and other food animals arrive these slaughterhouses from various parts of the state and the neighboring states for slaughter.

Study design

A cross sectional survey was conducted using structured questionnaires.

Study population

Slaughterhouse workers, that include the meat inspectors (veterinarians and animal health technologists), meat processors, meat sellers, and sanitary officials (cleaners) among others, formed the study population. Inclusion criteria for the participants were: from 20 years of age and not a visitor to any of the selected slaughterhouse at the time of questionnaire administration. A worker was excluded even if he met the above criteria but was not present at the time of the questionnaire administration in the slaughterhouse.

Sample size and data collection

Structured close-ended questionnaires were self-administered on the workers. Being a cross-sectional survey, sample size was determined using the method described by Thrusfield (2009). From the workers population, a hypothesized percentage frequency of outcome factor in the population (p) of 50% at 95% confidence interval, with degree of precision (d) of 5% and a design effect of 1.0 (random sampling) was used, and we obtained 385 as the required sample size. The participants were selected using a simple random sampling by balloting system. Questionnaires were pretested and self-administered on the sample slaughterhouse workers, ages 20 years and above, between January 2013 and April 2013 in hard copies by trained interviewers, to gather data on respondents' demography as well as knowledge and preventive measures about slaughterhouse operations. Observation checklist was also used to observe the onsite slaughterhouse premises for hygienic and sanitary operations and otherwise.

Defined variables

Knowledge and preventive practices were the two major outcome variables considered in this survey. The responses regarding the respondents knowing about slaughterhouse itself, slaughterhouse hygiene,

slaughterhouse sanitation, where animals are slaughtered, how animals are slaughtered and dressed as well as wastes disposal in the slaughterhouse were considered as constituting knowledge about slaughterhouse operations. To measure knowledge, the scoring system ranged between 0 and 20 points which were converted to 100%. The score range was further categorized into 'poor' (≤10 points, ≤50%) and 'satisfactory' (≥11 points, ≥51%) as binary variables.

In the structured questionnaires, respondents were asked about what they considered to be the 'definition of slaughterhouse. The other questions asked relating to knowledge were definitions of slaughterhouse hygiene and sanitation, and 'knowledge about preventive practices and implications of not observing good measures to human and environmental health. As the distribution was segregated by literacy level, formal education attainments were coded for analysis as: (a) none, (b) primary (first 6 years), (c) secondary (second 6 years), and (d) tertiary (third 4 years and above).

The basic preventive practices, specifically the use of masks, gloves, apron and rubber boots, hand washing after touching raw meat, presence of a hand washing facilities, and cleaning of utensils in the slaughterhouse were considered as being good practices. The score system in the case of preventive practices was ranged between 0 and 20 and also converted to 100%. They were further categorized into binary variables 'poor' (≤10 score) and 'satisfactory' (≥11 score). There were a total of 10 statements to measure preventive practices and include: use of apron, face mask, hand gloves, rubber boots, and eye goggles. Others are washing of hands with soap after touching raw meat, clean cutting utensils and surface, presence of hand washing facilities, frequency of cleaning and disinfecting, and wastes collection and disposal. One score was assigned per preventive statement. General perceptions of the workers on the impacts of unhygienic and unsanitary procedures on public and environmental health were also considered and assigned a score.

Data management and analysis

Collected data were summarized and entered into Microsoft Excel 7 spreadsheet (Microsoft Corporation©) and stored. Open Source Epidemiologic Statistics for Public Health (OpenEpi) software version 2.3 (Dean *et al*., 2009) was used for the statistical analysis. Descriptive statistics of means and rates were used to describe the socio-demographic characteristics of the respondents. The Chi-square test was used to examine the association between categorical socio-demographic and outcome variables (knowledge and preventive practices). Likelihood stepwise backward logistic regression was used to obtain the association of knowledge and preventive practices. P value <0.05 was considered statistically significant.

Results

A total of 385 usable responses were obtained; with majority (57.2%) of respondents having secondary education, 22.8% have completed primary education, 5.1% have tertiary education, while 14.9% have no formal education. The mean age of respondents was 40.8±10.7 years. Majority (94.0%) of the respondents were males and most of them (69.6%) were married. The majority (34.3%) of the respondents were in the age group 30–39 years. One in five (19.2%) respondents was illiterate. The majorities of the respondents (95.6% and 96.4%) did not have any previous training in meat hygiene and sanitation respectively. Most of the respondents (89.4%) were self-employed slaughterhouse workers. The survey revealed that 74.5% of the respondents had a poor knowledge (score 0–10), and the remaining had some good knowledge (score 11–17) about effective and efficient slaughterhouse operations.

Only about half of the respondents (56.6%) had knowledge about the actual meaning of slaughterhouse. Cleaning of cutting utensils and surface (17.4%) was the most common preventive practice, followed by the use of hand gloves (16.5%). Only 16.3% knew about the protective capacity of frequent cleaning and sanitation of slaughterhouse facilities, 14.5% mentioned rubber boots as an option, and only a few knew about the face mask (1.3%) and goggles (1.2%) to use. Majority (33.4%) knew incineration to be means of wastes disposal, 30.5% burial while 9.3% attested for by-products processing. Majority (39.2% and 37.7%) of the respondents respectively possess the knowledge that inadequate operations have public and environmental health implications, and 21.6% of them knew these factors to have effects on animal health. Regarding general preventive practices level of the respondents, the survey found that more than two third (86.2%) engaged in poor practices (score 1–5) and the remaining (13.8%) demonstrated satisfactory practices (score 11–14).

All the socio-demographic (independent/predictor) variables in the Chi-square test were statistically significantly associated with knowledge about slaughterhouse operations, while all variables except sex and marital status were significantly associated with preventive practices.

The sex, age, marital status, formal education, occupation, meat hygiene and slaughterhouse sanitation of respondents were significantly associated with having knowledge about slaughterhouse operations during univariate analysis (Table 1). All significant independent (socio-demographic) variables associated with the knowledge levels in the Chi-square test were further investigated by performing a multiple logistic regression. On subsequent logistic regression analysis, marital status, age, formal education, occupation, meat hygiene and slaughterhouse sanitation were the most significant factors determining respondents' knowledge about slaughterhouse operations. The slaughterhouse workers who are married were less likely [OR 0.554; 95% CI 0.325, 0.944)] to have poor knowledge about slaughterhouse operations than the unmarried ones; and those in the age group 60-69 years were less likely [OR 0.1345; 95% CI 0.0397, 0.4553)] to have poor knowledge than those in the 20-29 age group. The workers with secondary and tertiary formal education were less likely [OR 0.3557; 95% CI (0.1706, 0.7418); and OR 0.1259; 95% CI (0.0556, 0.2851) respectively] to have a poor knowledge than those without formal education. However, workers who are self-employed were much more likely [OR 71.15; 95% CI (16.79, 301.5)] to have satisfactory knowledge about abattoir operations than those paid by government. Also, regression analysis demonstrated that workers who have training in meat hygiene were less likely [OR 0.006362; 95% CI (0.0008184, 0.04946)] to demonstrate poor knowledge compared to the untrained ones. The study did not find significant association between training in meat hygiene and knowledge level (p=0.999) (Table 2).

Table 1: Association of socio-demographic variables with knowledge level

Factor	Categories	Satisfactory knowledge N (%)	Poor knowledge N (%)	Chi-square and p-value
Sex	Male	63 (17.4)	299 (82.6)	9.569
	Female	10 (43.5)	13 (56.5)	<0.002*
Age	20-29	15 (27.3)	40 (72.7)	13.130
	30-39	39 (29.6)	93 (70.4)	<0.0110*
	40-49	14 (11.7)	106 (88.3)	
	50-59	15 (26.3)	42 (73.7)	
	60-69	4 (19.1)	17 (80.9)	
Marital status	Single	22 (18.8)	95 (81.2)	4.793
	Married	79 (29.5)	189 (70.5)	<0.0290*
Formal education	None	7 (13.2)	46 (86.8)	99.450
	Primary	32 (33.0)	65 (67.0)	<0.0001*
	Secondary	51 (32.3)	107 (67.7)	
	Tertiary	69 (89.6)	8 (10.4)	
Occupation	Self employed	58 (16.9)	286 (83.1)	119.052
	Government	39 (95.1)	2 (4.9)	<0.0001*
Meat hygiene	Trained	11 (64.7)	6 (35.3)	94.855
	Untrained	15 (4.1)	353 (95.9)	<0.0001*
Sanitation	Trained	10 (71.4)	4 (28.6)	66.0515
	Untrained	26 (7.0)	345 (93.0)	<0.0001*

*Statistically significant at p <0.05

Table 2: Factors associated with knowledge level

Factor	Satisfactory knowledge (10.6%)	Poor knowledge (89.4%)	Odds ratio (OR)	95% CI (p-value)
Marital status				
Single	22 (18.8)	95 (81.2)	1.00	0.325, 0.944*
Married	79 (39.5)	189 (70.5)	0.554	(0.036)
Age				
20-29	20 (36.4)	35 (63.6)	1.00	0.0397, 0.4553*
60-69	17 (81.0)	4 (19.0)	0.1345	(0.001)
Formal education				
None	11 (20.8)	42 (79.2)	1.00	0.1706, 0.7418* (0.006)
Secondary	67 (42.4)	91 (57.6)	0.3557	0.0556, 0.2851*
Tertiary	52 (67.5)	25 (32.5)	0.1259	(0.000000224)
Occupation				
Self employed	74 (21.5)	270 (78.5)	71.15	16.79, 301.5*
Government	39 (95.1)	2 (4.9)	1.00	(0.0000001)
Meat hygiene				
Trained	16 (94.1)	1 (5.9)	0.006362	0.0008184, 0.04946
Untrained	34 (9.2)	334 (90.8)	1.00	(0.999)
Sanitation				
Trained	12 (85.7)	2 (14.3)	0.05212	0.01144, 0.2374*
Untrained	96 (25.9)	275 (74.1)	1.00	(0.00001584)

*All are statistically significant at p <0.05 except variables on meat hygiene

Table 3: Association of knowledge variables with preventive practices

Factors	Categories	Satisfactory preventive practice N (%)	Poor preventive practice N (%)	Chi-square and p-value
Definition of slaughterhouse	Correct	176 (71.0)	72 (29.0)	64.645
	Incorrect	39 (28.5)	98 (71.5)	<0.0001*
Definition of slaughterhouse hygiene	Correct	48 (31.4)	105 (68.4)	20.524
	Incorrect	29 (12.5)	203 (87.5)	<0.0001*
Definition of slaughterhouse sanitation	Correct	64 (46.7)	73 (53.3)	0.152
	Incorrect	121 (48.8)	127 (51.2)	<0.696
Use of protective materials	Yes	78 (29.7)	185 (70.3)	16.128
	No	62 (50.8)	60 (49.2)	<0.0001*
Aware of improper wastes disposal	Yes	62 (31.2)	137 (68.8)	27.148
	No	107 (57.5)	79 (42.5)	<0.0001*
Aware of effects of improper operations on public and environmental health	Yes	36 (29.5)	86 (70.5)	66.568
	No	193 (73.4)	70 (26.6)	<0.0001*

*Statistically significant at p <0.05

Table 4: Factors associated with preventive practices

Factors	Satisfactory preventive practice N (%)	Poor preventive practice N (%)	Odds ratio (OR)	95% CI (p-value)
Definition of slaughterhouse				
Correct	176 (71.0)	72 (29.0)	0.1628	0.1026, 0.2582*
Incorrect	39 (28.5)	98 (71.5)	1.00	(0.0000001)
Definition of slaughterhouse hygiene				
Correct	48 (31.4)	105 (68.4)	0.3125	0.1862, 0.5244*
Incorrect	29 (12.5)	203 (87.5)	1.00	(0.00001297)
Use of protective materials				
Yes	78 (29.7)	185 (70.3)	2.451	1.574, 3.816*
No	62 (50.8)	60 (49.2)	1.00	(0.0001084)
Aware of improper wastes disposal impacts				
Yes	62 (31.2)	137 (68.8)	2.993	1.971, 4.545*
No	107 (57.5)	79 (42.5)	1.00	(0.000000283)
Aware of the effects of improper operations on public and environmental health				
Yes	36 (29.5)	86 (70.5)	6.587	4.094, 10.6*
No	193 (73.4)	70 (26.6)	1.00	(0.0000001)

All are statistically significant at P<0.05

This study found that only one variable was not significantly associated with satisfactory practices (Table 3). On univariate analysis, all factors, except knowledge about the definition of slaughterhouse sanitation, were found to be significantly associated with the preventive practices (Table 3). On subsequent regression analysis, it was demonstrated that slaughterhouse workers who know correct definition of slaughterhouse were less likely [OR 0.1628; 95% CI (0.1026, 0.2582)] to demonstrate poor preventive practices, while those who know the correct definition of slaughterhouse hygiene were also less likely [OR 0.3125; 95% CI (0.1862, 0.5244)] to demonstrate poor preventive practices. Meanwhile, workers who use protective materials were more likely [OR 2.451; 95% CI (1.574, 3.816)] to demonstrate satisfactory practices; and those that are aware of improper waste disposal impacts were also more likely [OR 2.993; 95% CI (1.971, 4.545)] to show satisfactory practices. Nevertheless, those who are aware of the effects of improper operations on public and environmental health were also more likely [OR 6.587; 95% CI (4.094, 10.6)] to demonstrate satisfactory preventive practices (Table 4).

Discussion

The study revealed the proportions of slaughterhouse workers (butchers, veterinarians and animal health technologists doing meat inspection in slaughterhouses, cleaners and meat sellers at slaughterhouses) with knowledge of, and that carries out preventive practices on, various stages of slaughterhouse procedures in Niger state. It found poor knowledge and preventive practices among the workers. The findings indicated that only 20.0% of the workers had tertiary education while the majority (41.0%) had secondary education. Majorities (95.6% and 96.4%) do not have training in meat hygiene and abattoir sanitation respectively.

The knowledge level of the respondents about slaughterhouse operations was very poor; only about one-quarter (25.5%) of them had satisfactory knowledge score (11 – 17). Though more than half of the workers (56.6%) know about slaughterhouse to be a place where animals are slaughtered and their

meat processed, only 27.8 and 29.4% of them know about hygiene and sanitation respectively. Only few proportions of the workers have knowledge about protective materials such as the use of apron, hand gloves and rubber boots, and very few have knowledge about the use of face mask, eye goggles and washing of hands with soap after touching raw meat. About one-third (33.4%) of them have knowledge about incineration as the proper means of wastes collection and disposal. Also, about 39.2% and 37.7% know that unhygienic and unsanitary abattoir operations have effects on human and environment health respectively. The implications of these can be attributable to low formal education in most workers on good hygiene and adequate sanitation in the slaughterhouses.

This survey found that the marital status and certain age group of the workers were significantly associated with knowledge about slaughterhouse operations. It found that married workers and the older age group (60-69 years of age) had good knowledge about slaughterhouse operations than the younger age groups. The older respondents were likely to have been longer in the profession than the unmarried and younger ones. Due to many years of experience, the older workers might have been exposed to, and attended, different on-the-job trainings.

This study found that formal educational attainment of the respondents was significantly associated with knowledge and preventive practices in slaughterhouse operations. Knowledge was greater in persons with tertiary education. The higher education level could have increased the level of exposures to mass media and also may have contributed to increased risk awareness about cross infections with the meat and the environment. The educated individuals have more chances to get information about slaughterhouse hygiene and sanitation through newspapers, radio, television, and the internet. Though the study did not find significant statistical association between training in meat hygiene and knowledge level, workers with training still have less likelihood to demonstrate poor knowledge than those without training.

The majority of the workers (86.2%) do not engage in proper protective practices (score 1 – 5). This study found a substantial proportion of the respondents not to be following the recommended personal protective practices. Only 16.0% of them periodically use rubber boots, while 18.5%, 5.1% and 0.5% use aprons, hand gloves and eye goggles respectively. While 26.7% complied with cleaning of tools and surfaces, 13.2% and 15.0% engaged in the practice of frequent cleaning and disinfection, and proper wastes collection and disposal. It is likely that workers, especially the butchers, might have perceived themselves as being at a lower risk. However, the current findings of poor compliance with the preventive practices could be attributed to lack of good sanitary and hygienic enforcements on slaughterhouse workers by the appropriate government authorities.

The low use of protective practices increase the risk of cross contamination because meat handlers are probable sources of contamination for microorganisms. This is in agreement with reports of the World Health Organization (WHO, 2004) and Muinde & Kuria (2005) on cross contamination between food handlers and food products in meat workers that do not use protective materials. This is also supported by Nel *et al.* (2004) who reported wearing protective clothing to give protection to both food products and meat handler`s from cross contamination; and as well as Bryan (1988) who observed food handlers to be vectors for cross contamination through hands, cuts, mouths, skins and hairs whenever good personnel hygiene or proper handling are not practiced.

Hygiene problems are not limited to incorrect meat processing but also associated with unsanitary meat sales practices. This survey observed that most meat sellers in the slaughterhouses handle money concurrently with handling of meat. Since money is full of microbes, it can contaminate the meat and thence handling of meat with bare hands may cross contaminate meat. This is asserted by observations of Kumar *et al*. (2009) on the quality of beef produced and sold in parts of Tigrai region of Ethiopia when meat and money are not handled by same hand during sale of meat. Generally, it was observed that the poor knowledge of good sanitary operational procedures practiced by the workers could predispose to their poor personnel hygiene and with resultant neglect of good environmental sanitation. This agrees with the observations of Akinro *et al.* (2009) on the environmental implications of unhygienic operation by poor practices of meat processors in an abattoir in western Nigeria.

This study found a statistically significant relationship between knowledge and preventive practices. Knowledge, however little, can create awareness and thus enhance compliance with

healthy practices; awareness could cause respondents to perceive threat of poor hygiene and sanitation during slaughterhouse operations more readily. This is in line with an assumption of the Health Belief Model, that the perceived threat/susceptibility of a risk supports the development of healthy habits (Janz & Becker, 1984).

This study found a statistically significant relationship between knowledge and practices (Table 2). It has highlighted the critical factors that influence having knowledge about good slaughterhouse operations and compliance to adequate preventive practices among slaughterhouse workers. The heaps of wastes observed during the survey and which abound in the environment of these slaughterhouses can constitute serious environmental health hazards especially with tropical climatic conditions of the study area that tends to favor rapid deterioration of waste products as validated by workers' perceptions. This agrees with the reports of Adeyemo (2002) and Nafarnda & Obudu (2008) that rapid slaughter wastes deteriorations are favored by tropical climate. The seriousness of environmental pollutions observed from poor operations were further elucidated by reports of Callaway *et al.* (2004), and Abiade-Paul *et al*. (2006) on impacts of wastes and effluents in abattoirs.

This study also highlighted the critical factors affecting hygienic and sanitary operations among slaughterhouse workers in the state from the gap that exists in having proper knowledge about slaughterhouse operations to compliance with the standard preventive practices. The knowledge of the butchers was largely inadequate in view of the important public health roles that they play. Stakeholders should target these workers in training programs for better knowledge and sensitization for compliance with use of adequate preventive measures to promote hygienic and sanitary practices.

Though this study does not show causal relationship, being a cross-sectional study; it, however, demonstrated the association between socio-demographic variables, knowledge, and preventive practices that constitute the critical factors. To the best of our knowledge, this study was the first to explore the knowledge and preventive practices about hygienic and sanitary operations from slaughterhouse workers in Niger State, and it is expected to stimulate practical interest in the training of slaughterhouse workers on hygiene and sanitation of slaughterhouses to facilitate wholesome meat processing, animal, public and environmental health protections. The relatively small sample size is one of the major limitations of this study. These might have underestimated the effects of independent variables on the outcome variables.

In conclusion, the survey revealed some prevailing knowledge and preventive practice challenges facing slaughterhouse workers' operations in the state. The current study clearly pointed out that the respondents 20-29 years' and 'workers without formal education' should be specially targeted with educational activities relating to slaughterhouse operations; these groups had relatively poor knowledge about the operation. The relatively low knowledge of some workers about preventive measures has alerted that there is an immediate need to focus on promoting preventive practices. There is need to promote adequate and better knowledge and preventive measures in them in order to achieve wholesome meat production to the general public at slaughterhouses.

Conflict of interest

The authors wish to declare that they have no competing interests in the course of the research.

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