Knowledge, Attitude, and Practice of Abattoir Workers Toward Abattoirs Waste Management in Eastern Ethiopia

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ABSTRACT

BACKGROUND: During meat production, a large amount of wastes are generated that consist of feces, tissue waste, blood, fat, bone, animal trimmings, intestinal content, and urine that can be a potential risk to humans and the environment. Low knowledge, negative attitude, and poor practice can lead to poor waste management, which is more severe in developing countries like Ethiopia. Thus, the current study aimed to assess the knowledge, attitudes, and practices of abattoir workers toward abattoir waste management in Eastern Ethiopia.

METHODS: A cross-sectional study was conducted in Eastern Ethiopia' abattoirs from 1st to 30th of January, 2020. Two hundred and sixty-seven (n = 267) abattoir workers in 4 selected abattoirs (Haramaya University, Haramaya town, Harar town and Dire Dawa City administration) were interviewed using a pretested structured questionnaire. The data were analyzed using SPSS version 20 statistical package. Pearson's correlation was used to determine the strength between knowledge and attitude, knowledge and practice, and attitude and practice. A P-value of .05 was considered as a cut-off point for statistical significance.

RESULTS: This study revealed that 203 (76%) of the respondents had less knowledge, 69 (26%) had a positive attitude and 43 (16%) of them had a good practice toward abattoir waste management. There was a statistically significant difference between socio-demographic characteristics (education, work experience, and salary) and knowledge, attitudes and practices of the study participants. This study found moderate positive correlations between knowledge and attitude [$r = .404$, $P = .013$], weak positive correlations between knowledge and practice [$r = .229$, $P = .009$], and strong positive correlations between attitude and practice [$r = .717$, $P = .023$] of the abattoir workers toward waste management.

CONCLUSION: This study concluded that more than one-quarter, less than one-quarter, and about 3-quarter of the participants had less knowledge, negative attitude, and poor practice, respectively toward abattoir waste management. Therefore, regulatory bodies and other relevant industries must implement effective control measures that can be important to increase the knowledge, attitude, and practices of abattoir workers toward waste management.

KEYWORDS: Abattoir, waste management, abattoir workers, Ethiopia

Introduction

An abattoir is a premises approved and registered for hygienic slaughtering, inspection, processing, and preservation of meat products for human consumption.[1,2] During meat production, a large amount of wastes are generated that consist of feces, tissue waste, blood, fat, bone, animal trimmings, intestinal content, and urine that can be potential risk to humans and the environment.[3]

Abattoir operations produce a large amount of organic wastes with relatively high levels of suspended solids, liquid and fat.[4] The quantity of abattoir waste is staggering and a significant portion of food animals become waste. Approximately 50.0% to 54.0% of each cow, 52.0% of each sheep or goat, 60.0% to 62.0% of each pig, and 68.0% to 72.0% of each chicken are the meat consumed by human beings while the rest are discharged as the waste.[5]

In low-income countries, there is rapid urban growth resulting in high amount of abattoir waste in the urban areas.[6] Unless the appropriate action is taken, abattoir activities can result in environmental pollution. This portends hazard to both human and animal health.[7,8]

The US Centers for Disease Control and Prevention revealed that there could be outbreaks of foodborne diseases causing about 76 million illnesses, 325 000 hospitalizations, and 5000 deaths per year.[9,10] However, the problems related to poor abattoir waste management practices in developing countries are high as a result of low commitment of meat processing industries, lack of an appropriate abattoir waste disposal system, restriction of industry, and low awareness among slaughters, cleaners, and general abattoir workers toward the impacts of waste on the environment and human.[11] Disease outbreaks are common in developing countries as a result of poor waste management practices, particularly as a
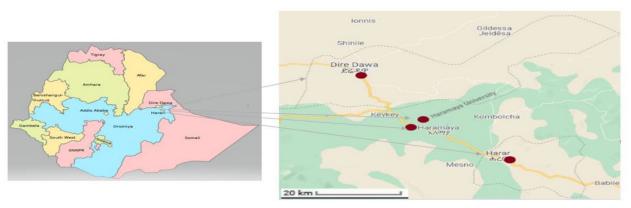
Figure 1. Map shows the study locations (Harar town, Haramaya University, Haramaya town, and Dire Dawa city) (Google Map).

result of inadequate waste disposal systems, lack of enforceable laws, weak regulatory structures, inadequate funding, and lack of awareness among waste-handlers. Compliance with safety precautions during meat processing and waste disposal are inadequate in Ethiopia.[12]

Beside these problems, there is inadequate abattoir waste management strategic plan due to inadequate knowledge and attitudes of abattoir workers in most developing countries[13] that need critical attention.[14] In Ethiopia, particularly in eastern Ethiopia, there is poor abattoir waste management that may have potential impact on public health and the environment. A large amount of wastes generated from the selected abattoirs in Eastern Ethiopia is simply discharged or released into the environment without any management system or treatment pond.[15] To reduce these problems, adequate knowledge and practice of proper waste management are of tremendous significance which considering the aforementioned hazards related to abattoir wastes coupled with other life limiting factors.[16]

Despite the fact that abattoir waste management is critical and potential hazard to health and pollutes environment, knowledge, attitude, and practices of abattoir workers have rarely been investigated in Ethiopia. Similarly, there is no adequate evidence available on abattoir workers' level of knowledge, attitudes, and practice (KAP) toward abattoir waste management and its impact in Eastern Ethiopia that can be used by policymakers, regulating authorities, investors, and top-managers to make the key health and safe policies and procedures to execute the waste management processes or practices in the abattoir industries to mitigate major health risks.

Therefore, this study aimed to provide current evidence on the level of knowledge, attitudes, and practice of abattoir workers toward waste management that can be used as an input for proper abattoir waste management to protect human health and the environment.

Materials and Methods

Study setting, design, and period

A cross-sectional study was conducted in Eastern Ethiopia abattoirs' (Harar town, Haramaya University, Haramaya town, and Dire Dawa city abattoirs) from 1st to 30th of January,

2020. They were selected purposively based on their scope (number of juice houses present, consumers or population size as well as and sociodemographic characteristics of the population). The first 3 study areas are Harar Abattoir, Haramaya University Abattoir Enterprise, and Haramaya Abattoirs, which are found in Harar; Haramaya University and Haramaya Towns of about 503, 508, and 527 km, respectively, far from the national capital of Addis Ababa. They are characterized by subtropical highland climate, throughout the year; afternoon temperatures are warm to very warm, cool at mornings, and raining season is between March and October. Dire Dawa Abattoir is located in Dire Dawa Administration which is about 453 km from Addis Ababa. It found at a latitude and longitude of 9°36′N and 41°52′E, respectively. The city is characterized by hot semiarid climate. Rainy season begins in March and ends in August in the region. Haramaya University and Haramaya town abattoirs are proximal to the Haramaya lake. Similarly, the topography (slope) of Harar town and Dire Dawa city may increase the risk of water pollution. In general, a map shows the study locations is provided below (Figure 1).

Study population

All permanent and contract workers in the selected abattoirs in Eastern Ethiopia were included in this study. All abattoir workers who worked in the selected abattoirs were included in this study. Daily abattoir workers who were unwilling to participate were excluded from this study.

Abattoir workers (skilled and un-skilled workers), that include the meat inspectors, meat processors and cleaners were included in this study. However, in this study areas, majority of abattoirs had no clear division of slaughter process (stunning, slaughtering/bleeding, and frozen delivery). Almost all abattoirs process was taken place simply on the ground and hanging were take place on metals. Based on their knowledge and attitude, the workers can also decide the process and proceed.

Sample size determination

The sample size was estimated using single proportion formula $N = \dfrac{z^2\,pq}{d^2}$, where: N is the required sample size, *Z* is the

reliability coefficient at 95% confidence interval (1.96), *p* is the population proportion, *q* is equal to 1−*p*, and *d* is the acceptable error (0.05). To the best of our knowledge, there is no available literature on KAP toward abattoir waste management, and the population proportion (*P* = .5) was used to determine the sample size required for the study.[17] The sample size was calculated as the following; -

$$\text{Sample size } \; n = \frac{(1.96)^2 (0.5)(0.5)}{(0.05)^2} = 384.$$

After the correction formula (nf = $\dfrac{ni}{1+ ni/N}$) and 5% participants for non-response rate were used, the final sample size required was 269 respondents.

Sampling procedures and techniques

The selection was based on the scope of the abattoir (amount of meat produced, and users). Then, the random sampling technique was used to select the abattoirs found in Eastern Ethiopia.[12] Among the workers in the abattoirs, 269 were selected proportionally (98% of workers from each location were interviewed) of which, 22, 28, 117, and 102 were selected from Haramaya University, Haramaya town, Dire Dawa city, and Harar town abattoir, respectively.

Study variables

Knowledge, attitude, and practices of abattoir workers were dependent variables while sociodemographic characteristics such as age, sex, educational status, work experience, and income/salary were independent variables.

Outcome measurements

Knowledge items: Twelve questions were prepared to determine the knowledge of abattoir workers. Each question had 2 choices; that is, a correct answer was assigned 1 score, whereas a 0 score was given for a wrong answer. The level of the knowledge was classified into 3: good knowledge (8-12 scores), fair knowledge (6-7) scores; and low knowledge (less than 6 scores).[12]

Attitude items: Eleven statements were developed and used to assess the attitude of the abattoir workers toward abattoir waste and scored using a Likert scale. Each question was measured as strongly agree (score 5), agree (score 4), neutral (score 3), disagree (score 2), and strongly disagree (score 1). Then, the attitude level was classified into 3 positive attitudes (44-55 scores), neutral attitude (26-43 scores), and negative attitude (26 scores).[12]

Practice items: Ten questions were developed concerning abattoir waste management practices, which was varied from 0 to 20. Each of the 10 items was assessed as 0-1 indicator (dichotomous) variables. The variables were given the value 0 for "no" and value 1 for "yes." Then the scores were classified into good practice (16-20 scores), fair practice (10-15 scores), and poor practice (<10 scores).[12]

Data quality control

The questionnaire used for data collection was prepared in English language, and contain both closed and open-ended questions. Then, the questionnaire was translated into local languages (Amharic and Afan Oromo). The data were collected after the training was provided for data collectors. Pretesting of the questionnaire was demonstrated in Awaday town abattoir by administering to abattoir workers to determine the clarity of the questions. The questionnaire was modified, and the second version was used to collect the data. The questionnaire was weighed to check the accuracy of the data entry by data cleansing and the exploration method in the database.[12]

Data analysis

The collected data were entered using EpiData Version 3.1 statistical software and analyzed using SPSS version 20 statistical package. Descriptive statistics such as frequency, percentage, mean, and standard deviation (SD) were computed for numerical data. Chi-square test (χ^2) was used to determine the degree of association, while the Pearson's correlation (*r*) was used to determine the strength between knowledge and practice; knowledge and attitude and attitudes and practice of the workers.

Correlations were interpreted using Cohen (1988) and Evans (1996) correlation coefficient criteria. Based on these criteria, the cut-off point of correlation was very weak (0.20-0.39), Weak (0.40-0.59), Moderate (0.60-0.79) and strong and very strong (0.80-1.00) *either positive, neutral, or negative*. While, the cut-off points for KAP were 80.0% to 100%, 60% to 79%, and ≤59% for *positive, neutral, or negative, respectively*.[12]

Results

Socio-demographic characteristics

From a total of 269 abattoir workers, 267 (99.0%) of the respondents participated in the study. About 242 (90.6%) of them were male. Ninety-four (35.2%) attended primary school (grades 5-8), 124 (46.4%) had 1 to 4 years work experience, and 122 (45.7%) earned income between 2009 and 3278 Ethiopian Birr per month (Table 1).

Knowledge of abattoir workers on waste disposal

The study found 176 (65.9%) of the respondents reported that bone is the only abattoir waste composition while the others reported that abattoir waste includes blood, tissue,

Table 1. Sociodemographic characteristics of 267 workers in selected abattoirs (Harar and Haramaya Towns, Haramaya University and Dire Dawa city) in Eastern Ethiopia, January 2020.

VARIABLES	CATEGORIES OF VARIABLES	RESPONDENTS (N=267)		
		FREQUENCY	PERCENTAGE (%)	SD
Sex	Male	242	90.6	0.29
	Female	25	9.40	
Age	<18 years	9	3.4	0.92
	19-24 years	51	19.1	
	25-35 years	123	46.1	
	36-45 years	64	24.0	
	>45 years	20	7.5	
Religion	Muslim	130	48.7	0.82
	Orthodox	104	38.95	
	Protestant	23	8.6	
	Other	10	3.7	
Educational status	Unable to read and write	10	3.7	1.56
	Able to read and write	17	6.4	
	Grades 1-4	27	10.1	
	Grades 5-8	94	35.2	
	Grades 9-10	79	29.6	
	Grades 11-12	13	4.9	
	Certificate/Diploma	7	2.6	
	First degree and above	20	7.5	
Work experience	<1 year	21	7.9	1.20
	Between 1 and 4 years	124	46.4	
	Between 5 and 8 years	58	21.7	
	Between 9 and 12 years	22	8.2	
	>12 years	42	15.7	
Monthly salary	<1123 ETB*	15	5.6	1.00
	Between 1124 and 2008 ETB	75	28.1	
	Between 2009 and 3278 ETB	122	45.7	
	Between 3279 and 3740 ETB	29	10.9	
	>3740 ETB	26	9.7	

Abbreviations: ETB, Ethiopian Birr; n, sample size; SD, standard deviation.

intestine, horn and feather. About 116 (43.3%) respondents did not know about underground water pollution due to improper handling and disposing of abattoir waste. Furthermore, the study found 237 (88.8%), 174 (65.2%), 220 (82.4%), and 128 (47.9%) of the respondents reported that abattoir waste can serves as a breeding place for insects, pollutes surface water, can be used as biofertilizer and bioenergy, respectively (Table 2).

Table 2. Knowledge of abattoir workers toward abattoir waste management in selected abattoirs in eastern Ethiopia, January 2020.

SR. NO.	KNOWLEDGE STATEMENTS (N=267)	RESPONDENTS		
		CATEGORY	FREQUENCY	PERCENTAGE
1.	Do you know what abattoir waste is?	Yes	259	97.0
		No	8	3.0
2.	If yes for "#Q1," which one do you consider as abattoir waste? (n=159)	Bone	176	65.92
		Liquid waste such as blood and waste water.	144	53.9
		Intestine	28	10.5
		Tissue	34	12.7
		Feather	135	50.56
		Horn	155	58.0
3.	Do you know that abattoir waste, if improperly handled and disposed, generates bad odor?	Yes	251	94.0
		No	16	6.0
4.	Do you know that bad odor from abattoir waste affects the health of people?	Yes	243	91.0
		No	24	9.0
5.	Do you know that abattoir waste if improperly handled and disposed, serves as a breeding ground for flies and mosquitoes?	Yes	237	88.8
		No	30	11.2
6.	Do you know that abattoir waste if improperly handled and disposed could attract animal scavengers?	Yes	243	91.0
		No	24	9.0
7.	Do you know that abattoir waste if improperly handled and disposed pollutes air?	Yes	174	65.2
		No	93	34.8
8.	Do you know that abattoir waste if improperly handled and disposed pollutes surface water?	Yes	199	74.5
		No	68	25.5
9.	Do you know that abattoir waste if improperly handled and disposed pollutes underground water?	Yes	151	56.6
		No	116	43.4
10.	Do you know how abattoir waste should be disposed?	Yes	169	63.3
		No	98	36.7
11.	Do you know that abattoir waste could be used as biofertilizer?	Yes	220	82.4
		No	47	17.6
12.	Do you know that abattoir waste could be used as animal feed?	Yes	228	85.4
		No	39	14.6
13.	Do you know that abattoir waste could be used as bioenergy?	Yes	128	47.9
		No	139	52.1

Abbreviations: n, sample size; Q, question.

Attitude of abattoir workers

A total of 145 (54.0%) of the participants agreed that abattoir waste could cause offensive odor to the surrounding environment, 120 (44.9%) agreed that odor from abattoir waste could pose a health problem to people, 44 (53.9%) agreed that waste drained from the abattoir serves as a breeding ground for flies and mosquitoes, and 142 (53.2%) agreed that abattoir waste discharged from their abattoir could attracts animal scavengers (Table 3).

Table 3. Attitude of abattoir workers in 4 selected abattoirs in Eastern Ethiopia toward abattoir waste management, 2020.

SR. NO.	ATTITUDE STATEMENTS (N=267)	CATEGORY	FREQUENCY	PERCENTAGE
1.	Waste from your abattoir releases could cause offensive odor to the surrounding environment.	Strongly disagree	5	1.9
		Disagree	16	6.0
		Neutral	6	2.2
		Agree	145	54.3
		Strongly agree	95	35.6
2.	Odor from abattoir waste could pose a health problem to people	Strongly disagree	5	1.9
		Disagree	7	2.6
		Neutral	27	10.1
		Agree	120	44.9
		Strongly agree	108	40.4
3.	Waste drained from your abattoir serves as a breeding ground for flies and mosquitoes.	Strongly disagree	5	1.9
		Disagree	7	2.6
		Neutral	26	9.7
		Agree	144	53.9
		Strongly agree	85	31.8
4.	Waste discharge from your abattoir attracts animal scavengers.	Strongly disagree	8	2.9
		Neutral	8	3.0
		Agree	142	53.2
		Strongly agree	109	40.8
5.	Waste discharge from your abattoir could pollute the air.	Strongly disagree	8	3.0
		Disagree	45	16.9
		Neutral	68	25.5
		Agree	98	36.7
		Strongly agree	48	18.0
6.	Waste from your abattoir could pollute surface water?	Strongly disagree	6	2.2
		Disagree	29	10.9
		Neutral	57	21.3
		Agree	149	55.8
		Strongly agree	26	9.7
7.	Waste discharge from your abattoir could pollute underground water.	Strongly disagree	7	2.6
		Disagree	45	16.9
		Neutral	102	38.2
		Agree	91	34.1
		Strongly agree	22	8.2
8.	Waste disposed from your abattoir could be used as animal feed.	Strongly disagree	17	6.4
		Disagree	27	10.1
		Neutral	5	1.9
		Agree	148	55.4
		Strongly agree	70	26.2

(Continued)

Table 3. (Continued)

SR. NO.	ATTITUDE STATEMENTS (N=267)	CATEGORY	FREQUENCY	PERCENTAGE
9.	Waste disposed from your abattoir could be used as biofertilizer?	Strongly disagree	14	5.2
		Disagree	47	17.6
		Neutral	16	6.0
		Agree	153	57.3
		Strongly agree	37	13.9
10.	Waste from your abattoir could be used as biofuel?	Strongly disagree	40	15.0
		Disagree	74	27.7
		Neutral	39	14.6
		Agree	97	36.3
		Strongly agree	17	6.4
11.	Waste from your abattoir is properly disposed now?	Strongly disagree	63	23.6
		Disagree	147	55.1
		Neutral	42	15.7
		Agree	11	4.1
		Strongly agree	4	1.5

Abbreviation: n, sample size.

Practice of abattoir workers

Among the study participants (N=267), 88.4% separate the edible part from nonedible parts properly in their daily work activities. However, 81.6% did not use abattoir waste as biofertilizer. Moreover, about 54.0% and 75.0% of them did not use abattoir waste for biogas and for compost, respectively (Table 4).

Association of KAP and sociodemographic characteristics

More than 3-quarter (76.0%) of the workers had a good level of knowledge, 193 (72.2%) had a neutral attitude, and 83.9% had fair practice toward abattoir waste management. Educational status, work experience, and salary of the respondents significantly ($P<.05$) associated with their knowledge, attitudes, and practices (Table 5).

Correlation between knowledge, attitude, and practice

The correlation result revealed that there was a significant positive linear correlation between knowledge and attitude, knowledge, and practice as well as attitude and practice (Table 6).

Discussion

In the current study, a high percentage (74.8%) of the study participants reported that abattoir wastes do not consist of blood, tissue, intestine, horn and feather that was lower than the findings of another study conducted in Malaysia which found

82.60% abattoir workers reported the same issues.[12] About 139 (52.0%) of the participants did not know about underground water pollution as a result of improper handling and disposal of abattoir waste. This finding is similar to those from Malaysia which reported 50.40%[12] and 50.9% reported from Nigeria.[18]

Furthermore, 251 (94.0%) of the participants agreed that if abattoir waste is improperly handled, it could produce a bad odor that could affect the health of people and attract scavengers. Waste discharged from abattoirs is one of the most significant sources of water pollution.[19] However, the current study found 116 (43.4%) of the respondents did not know about underground water pollution due to improper handling and disposing of abattoir waste. This may influence abattoir waste management practices and may lead to environmental pollution and pose health impacts. Overall, 76% of the studied participants had good knowledge of abattoir waste management, higher than 51.5% reported earlier in Nigeria.[16]

Accordingly, 145 (54.3%) of the participants agreed that if improperly discharged, abattoir waste could cause offensive odor to the public and surrounding environment while 144 (53.9%) agreed that the waste drained from the abattoir serves as a breeding ground for flies and mosquitoes. This finding is consistent with existing findings that reported 84.44% of participants who agreed on the same issues.[18] In addition, 55.4%, 57.3%, and 36.35% of the participants believe that abattoir wastes could be used as animal feed, biofertilizer, and biofuel that can be supported by the work done in Ethiopia.[20] Furthermore, the study found 69 (26%) of the participants had

Table 4. Practices of abattoir workers in Eastern Ethiopia toward abattoir waste management, 2020.

SR. NO.	PRACTICE STATEMENTS	CATEGORY	RESPONDENTS (N=267)	
			FREQUENCY	PERCENTAGE
1.	Do you properly separate the edible parts from nonedible parts in your daily work activities?	Yes	236	88.4
		No	31	11.6
2.	Do you use abattoir waste as biofertilizer for surroundings?	Yes	49	18.4
		No	218	81.6
3.	Do you use some important abattoir waste for animal feed?	Yes	220	82.4
		No	47	17.6
4.	Do you use the abattoir waste for biogas?	Yes	123	46.1
		No	144	53.9
5.	Do you prepare bone, blood and feather meal from abattoir waste?	Yes	87	32.6
		No	180	67.4
6.	Do you segregate semi-solid/liquid parts from solid waste before disposal?	Yes	193	72.3
		No	74	27.7
7.	Do you dispose liquid abattoir waste on the agricultural fields as fertilizer?	Yes	144	53.9
		No	123	46.1
8.	Do you dispose abattoir waste by incineration?	Yes	201	75.3
		No	66	24.7
9.	Do you dispose abattoir waste by burial?	Yes	155	58.1
		No	112	41.9
10.	Do you use abattoir waste as compost?	Yes	66	24.7
		No	201	75.3

Table 5. Association between sociodemographic characteristics and knowledge, attitude, and practice level of abattoir workers in Eastern Ethiopia, 2020.

RESPONDENTS (N=267)		VARIABLES					
KAP VARIABLES	F (%)	SEX	AGE	EDUCATION	RELIGION	WORK EXPERIENCE	SALARY
Knowledge level							
Good (8-12)	203 (76%)	$1.95^{a,*}$ (.376)	9.26^a (.321)	38.91^a (<.001)	18.83^a (.004)	24.56^a (.002)	32.61^a (<.001)
Fair (6-7)	48 (18%)						
Poor (<6)	16 (6%)						
Attitude level							
Positive (44-55)	69 (25.8%)	2.00^a (.037)	16.40^a (.367)	77.22^a (<.001)	7.45^a (.012)	28.02^a (.001)	43.68^a (.003)
Neutral (26-43)	193 (72.2%)						
Negative (<26)	5 (2.0%)						
Practice level							
Good (16-20)	43 (16.1%)	1.27^a (.258)	5.17^a (.271)	42.37^a (<.001)	4.47^a (.348)	31.78^a (.003)	43.41^a (<.001)
Fair (10-15)	224 (83.9%)						
Poor (<10)	-						

Abbreviations: F, frequency; n, total sample size.
The number in parentheses shows alpha at .05.
a,*Indicates Pearson chi-square (χ^2).

Table 6. Correlation between levels of knowledge, attitudes, and practices of abattoir workers, 2020.

KAP VARIABLES (N = 267)	CORRELATION COEFFICIENT (*R*)	P-VALUE (α = .05)
Knowledge—Attitude	.404	.013
Knowledge—Practice	.229	.009
Attitude—Practice	.717	.023

Abbreviations: A, attitude; K, knowledge; P, practice.

positive attitude toward abattoir waste management, which is consistent with 24.4% reported in Nigeria.[16]

Additionally, the current study reported that 236 (88.4%) of the participants properly separated edible parts from non-edible parts in their daily work activities while 218 (81.6%) of abattoir workers did not use abattoir waste for local biogas and compost. This high percentage may be related to the culture, low attitude and poor encouragement from the concerned agencies. Overall, the current study found only 43(16.0%) of the participants had good practice toward waste management that was lower than the finding of another study which reported that, 97.4% of participants applied good waste management practices.[16]

Again, this study revealed that education ($P < .001$), religion ($P = .004$), work experience ($P = .002$), and income/salary ($P < .001$) were significantly associated with knowledge. In contrast, a study conducted in Nigeria reported a significant association between knowledge level of safe meat handling and age, education, and work experience ($P < .05$).[11] Another study conducted in Malaysia also reported the significant ($P < .05$) association between gender and knowledge level of the abattoir workers.[12]

Furthermore, the current study revealed that there was a significant ($P < .05$) association between abattoirs' attitude level and their education, religion, work experience, and salary. Except religion, the current result is consistent with the previous study conducted in Malaysia reported a significant association between the attitude of abattoir workers and education, work experience and income.[12] In addition, there was statistically significant ($P < .05$) association between the level of practical activities and education, work experience, and income of abattoir workers. The finding of the current study was consistent with other studies conducted in Malaysia[12] and Nigeria.[18]

Overall, the correlation between knowledge and attitude of abattoir workers was positive and moderate ($r = .404$, $P = .013$) but weakly positively correlated with practice ($r = .229$; $P = .009$), which indicates that increase in knowledge, increases attitude and practice levels toward abattoir waste management.[21] Moreover, the correlation between attitude and practice of abattoir workers was positive and strong ($r = .717$, $P = .023$).[21] In general, the study on correlation of knowledge, attitude, and practices of workers revealed that there was a positive correlation between knowledge and attitudes; knowledge and practices; attitudes and

practices toward abattoir waste management. Therefore, increasing the knowledge, attitude, and practices of abattoir workers by providing adequate training or increasing awareness is essential to improve the abattoir waste management.[22] Policies, including strict supervision and regular hygienic regulations at all level should therefore be tightened to ensure the protection of the food safety.[23]

In general, regulatory bodies and other relevant agencies or industries must have to implement effective control measures such as providing adequate training and regular supervision to increase the knowledge, attitude, and practices of abattoir workers for better management of abattoir waste and to protect the human health and environment.

Conclusion

The study revealed that about one-quarter, less than one-quarter and about 3-quarter of abattoir workers had positive attitude, good practice and good knowledge, respectively toward abattoir waste management. This finding indicates that there is the gap in knowledge, attitude, and practice among abattoir workers and the need to improve them. In general, regulatory bodies and other relevant agencies or industries must have to implement effective control measures such as adequate training, and regular supervision to increase the knowledge, attitude, and practices of abattoir workers for better management of abattoir waste and to protect the human health and environment.

Author Contributions

STT conceived the idea. STT, FKA, and DAM involved in analysis data, drafting and writing results. Finally, all authors read and approved the final version of the article to be published and agreed on all aspects of this work.

Availability of Data

Almost all data are included in this manuscript. However, additional data will be available from the corresponding to the reasonable request.

Ethics Approval

Ethical approval for this study was obtained from the Institutional Health Research Ethics Review Committee (IHRERC) with a grant number HUKT-2018-03-63.

Informed Consent

Written informed consent was obtained from the representatives or the concerned organization before the study. Written informed consent was obtained from all study participants/interviewee before the study.

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