

Research Article

# Knowledge, Attitude, and Practice of Meat Hygiene Among Butchers in Abattoirs and Meat Markets in Wadi Salih Garsila, Central Darfur - Sudan

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## Abstract

This study aimed to assess the knowledge, attitudes, and practices related to meat hygiene among butchers and meat workers in abattoirs and markets in Garsila. A total of one hundred structured questionnaires were used to collect data on participants' knowledge and practices regarding meat hygiene, and data analysis was performed using SPSS version 21. The results showed that all butchers (100%) in this study were male, with 27% aged between 36 and 45 years. Less than half (41%) of the butchers were older than 46. Additionally, 90% of butchers were married, while 10% were single. The study found that 46% had less than 10 years of work experience, while 24% had 11 to 20 years of experience. Notably, 90% of butchers were uneducated, with only 1% holding a university degree. Furthermore, 99% believed regular handwashing can reduce the risk of meat contamination, and 84% thought using appropriate gloves could minimize contamination. However, 20% believed that freezing meat is not important for preservation. There was unanimous agreement among all butchers that wearing clean personal protective equipment improves meat hygiene. In conclusion, the study indicates moderate awareness regarding meat hygiene among butchers and meat workers in Wadi Salih Garsila.

## Keywords

Abattoirs, Butchers, Hygiene, Meat, Knowledge

## 1. Introduction

Food-borne diseases have been considered a main human health matter occurring generally in developing countries, especially in African countries, because of unsanitary treat-

ment of food and poor hygiene practices [1]. The first international estimation of foodborne disease progressive to date shows that 2 in 20 people get ill from eating contaminated

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food each year, and 420,000 die from it [2]. The most substantial food exporters of the outbreaks were eggs, mixed food, fish and meat, and meat products [3]. The World Health Organization (WHO) estimated that worldwide foodborne illnesses are the reason for 600 million cases of ill health and 420,000 deaths annually, in the total of deaths, about 30% of these deaths were children less than 5 years old [4]. In growing nations, every year one-third of the total people are probably suffering from food-borne illness, and about 70% of the cases are related to the consumption of polluted food [5]. Food safety hazard analysis is used to assess the hazards to public health from food-borne risks, recognize and perform adequate hazard management measurements to decrease those hazards, and transfer with stakeholders about the hazards and measurements applied [6]. Workers in abattoirs, who are attracted to unsanitary exercise, contribute to climate zoonosis among the workers, and pollution of the meat for sale [7]. Developments and perfection in the classic tactic of meat hygiene have also been a focus of global organizations [8]. No tools in the slaughterhouses may command the production of harmful meat which can have critical health complications for consumers [9]. Quality of meat is related to stress so large animals need enough time to recover from transportation stress to improve meat quality and other practices management pre-slaughter [10]. Slaughterhouses are a main hazard for infectious diseases, with far-reaching transportation implications that demand dense public health interference [11].

Therefore, the consumption of meat and meat production in Sudan has been extensively associated with cultural practices and religious beliefs [12]. Meat hygiene indicates a group of actions that want the application of fixed standards, icons of practice, and regulatory activities by the regulatory person to include the safety of the meat for humans to eat. Meat hygiene requirements must be met at various steps of production, operation, and transport, as well as for slaughter, meat processing tools, meat handlers, and the environment [13]. To provide a chance to improve meat safety performance in SMEs that is important to consumers in terms of food supply [14]. In Sudan, several studies have been conducted on the meat safety knowledge, attitudes, and practices of meat handlers, but none have specifically focused on assessing the knowledge, attitudes, and practices of food handlers [5]. In any case of the transcend side of animal and zoonotic disease domination, meat safety, and public health, the slaughterhouse supplies an important source of information for livestock health. Registration of reasons for damnation in those nations with enough meat snooping is base for epidemiological disease control and welfare management [16]. In this study, we concentrated on meat safety practices including sanitation, hygiene, and handling of the key chain actors that provide meat to consumers in Garsila. For this purpose, we designed a questionnaire to assess meat safety and hygienic practices in slaughterhouses and abattoirs because these places are highly susceptible to contaminations that can cause severe foodborne diseases [17]. To the best of our knowledge,

this study represents the first attempt to evaluate the knowledge and practices related to meat hygiene in Garsila. The objective of this study was to assess the knowledge, attitudes, and practices concerning meat hygiene among butchers working in abattoirs and markets within Wadi Salih.

## 2. Materials and Methods

### 2.1. Study Area



**Figure 1.** Map Verifying central Darfur state (Area of The Study).

This study was conducted in Wadi Salih Garsila Central Darfur state located in western Sudan at  $12^{\circ} 54' 0''$  north latitude and  $23^{\circ} 29' 0''$  east longitude, Figure 1. The population of Central Darfur state is slightly more than 1.6 million people. Nearly one-fifth of the population is currently classified as internally displaced persons. There are approximately one million children (aged 0-18) in Central Darfur, and about 350,000 youth (aged 18-24). The majority of the population does not enjoy their full rights, and most have significant humanitarian and development needs. The predominant religion in the area of the study is Islam, with a minority of Christians and non-religious individuals. The ethnicities present in the area of the study include the Fur, which is the predominant tribe. Other tribes in the region are the Bani Halba, Rizeigat, Tama, Ja'alin, Ta'aisha, Bergo, Masalit, Berti, Falata, Bani Hussein, Khozam, Habania, Zaghawa, Salamat, Misseriya, Nawaiba, Dajo, and others. Conflict, floods, and drought have caused significant displacement in the state. The internally displaced persons in the area of the study, including large numbers of children and women, lack access to basic social services [15]. The state consists mainly of poor savanna, surrounded by desert sands to the north, and the Marra Mountain to the east. The weather is sunny in most seasons of the year and cloudy in Autumn; the range of temperature is 30 to 33 degrees in summer, [18].

### 2.2. Data Collection and Questionnaire Design

The primary method employed for data collection in this

study involved face-to-face interviews with butchers and meat workers at abattoirs and markets. The research took place in Wadi Salih Garsila from December 15, 2023, to January 5, 2024, aiming to evaluate the hygiene standards, knowledge, and practices of meat among butchers and meat dealers.

### 2.3. Questionnaire Design

The questionnaire was designed from the literature review based on the study questions proposed and it covers 4 sections, section one included data on the demographic characteristics of butchers and meat workers. Section two included Knowledge of meat hygiene, section three included butchers' and meat workers' attitudes toward meat hygiene, and section four included butchers' and meat workers' practices Assessment [19].

### 2.4. Data Analysis

The data were analyzed using SPSS Version 21.0 (IBM Corporation, NY). A cumulative score was assigned to each variable, representing the total score for each questionnaire item. Percentages and frequency distributions were calculated. The statistical significance of the differences between butchers was determined using the frequency table [20].

## 3. Result

### 3.1. Demographic Characteristics of Respondents

The study showed that all butchers in this study were male (100%, Figure 2). Less than half of the respondents (41%) were above 46 years old, and 27% were aged 36 to 45 years (Figure 3). It was found that 90% of respondents were married, (Figure 4). Less than half (46%) had less than 10 years of work experience (Figure 5), while 24%, 16%, and 14% had work experience ranging from 11 to 20 years, 21 to 30 years, and more than 30 years, respectively. The study revealed that 69% of respondents had no education, only 1% had graduated from a university, and 21% and 9% had primary and secondary school education, respectively (Figure 6).

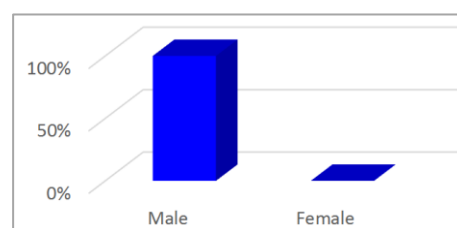


Figure 2. Respondents' s gender.

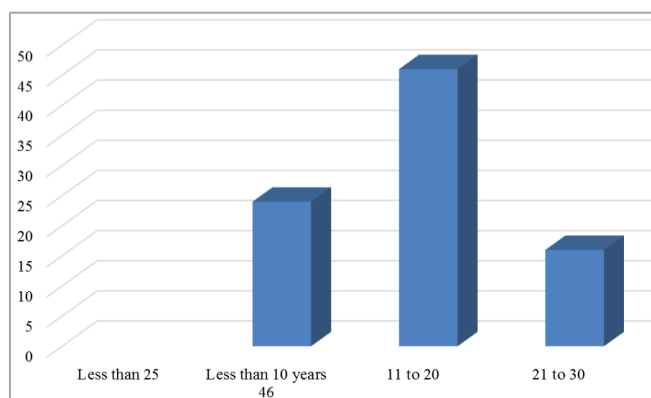


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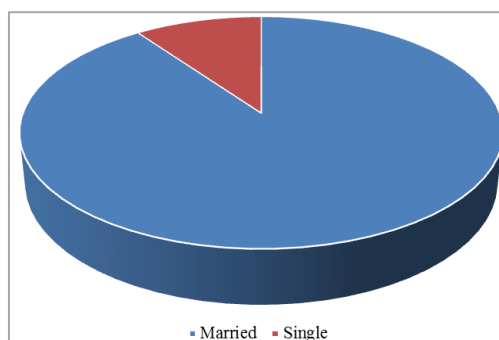
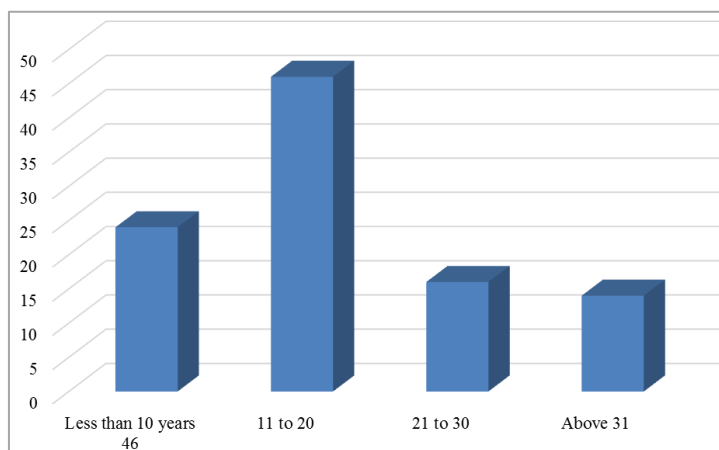
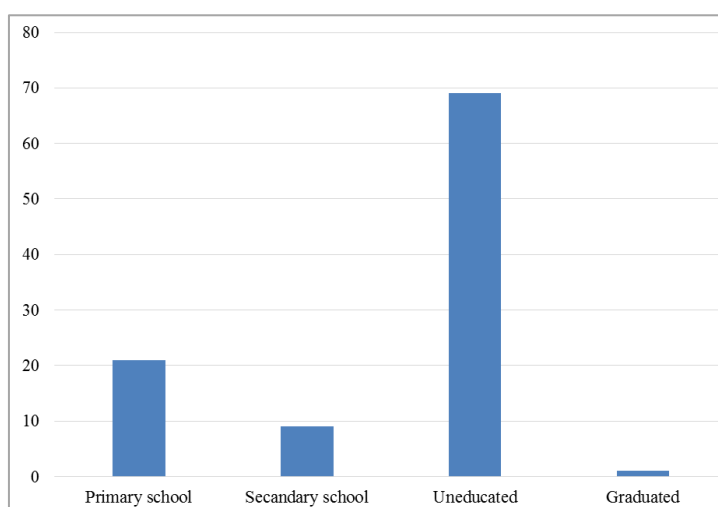


Figure 4. Respondents' maretal status.



**Figure 5.** Respondents' experience years.



**Figure 6.** Respondents' educational levels.

### 3.2. Respondent Practice Assessment

As shown in Table 1, the results indicate that 99% of respondents believe regular handwashing reduces the risk of meat contamination, while 84% think that using appropriate gloves decreases this risk. Additionally, 80% consider freezing meat important for preservation, and about 54% believe that washing live animals before slaughter is essential. Con-

versely, 42% of respondents do not see washing live animals as important, and approximately 89% believe that carcasses can be contaminated in dirty environments. According to this study, 54% of respondents have a proper understanding of potential contamination sources in meat, while 46% lack this knowledge. Furthermore, 48% of respondents are aware of the causes of foodborne diseases, but 45% are unaware. Notably, 98% believe that meat inspection to rule out infection is crucial.

**Table 1.** Respondent Practice Assessment.

Variables	No	frequency	Percent (%)	Cumulative percent (%)
Do you think regular washing of hands reduces the risk of meat contamination?	100			
Yes		99(99)	99.0(99.0)	99.0
No		1(1)	1.0(1.0)	100.0

Variables	No	frequency	Percent (%)	Cumulative percent (%)
Total		100	100.0	
Do you think using appropriate gloves reduces contamination?	100			
Yes		84(84)	84.0(84.0)	84.0
No		16(16)	16.0(16.0)	100.0
Total		100	100.0	
Do you think freezing meat is important for preservation?	100			
Yes		80(80)	80.0(80.0)	80.0
No		20(20)	20.0(20.0)	100.0
Total		100	100.0	
Do you think washing live animals is important before slaughter?	100			
Yes		54	54.0(54.0)	54.0
No		42	42.0(42.0)	96.0
I don't know		4	4.0(4.0)	100.0
Total		100	100.0	
Do you think carcasses can be contaminated in a dirty environment?	100			
Yes		89(89)	89.0(89.0)	89.0
No		11(11)	11.0(11.0)	100.0
Total		100	100.0	
Do you have proper knowledge of potential contamination sources?	100			
Yes		54(54)	54.0(54.0)	54.0
No		46(46)	46.0(46.0)	100.0
Total		100	100.0	
Do you know knowledge of cause food borne disease?	100			
Yes		48(48)	48.0(48.0)	48.0
No		45(45)	45.0(45.0)	93.0
I don't know		7(7)	7.0(7.0)	100.0
Total		100	100.0	
Do you think inspecting meat to rule out infection is important	100			
Yes		98(98)	98.0(98.0)	98.0
No		2(2)	2.0(2.0)	100.0
Total		100.0	100.0	

### 3.3. Respondent's Attitude Toward Meat Hygiene

Table 2 demonstrates the respondent's attitude toward meat hygiene. The study showed that all respondents agreed that wearing clean personal protective equipment at work im-

proves meat hygiene; therefore, 86% of them agreed that antemortem and postmortem inspections are essential for hygienic production. About 53% of respondents agreed that eating and drinking should be allowed in the slaughter area, while 47% disagreed with allowing eating and drinking in that area. The study found that 99% of respondents agreed that changing or sterilizing knives after each processing step is

good for meat hygiene. In addition, all respondents in this study agreed that slaughtering and processing meat on a clean slaughter floor is comparable to that on the slaughter line. Therefore, 80% of respondents agreed that meat handlers can

contaminate meat when they are ill with contagious diseases, while 92% of them disagreed with rubbing the meat with fresh blood to make it look good.

**Table 2.** Respondent's attitude toward meat hygiene.

Variables	No	Frequency	Percent (%)	Cumulative percent (%)
Does wearing a clean uniform at work improve meat hygiene	100			
Agree		100(100)	100.0(100.0)	100.0
Disagree				
Total		100	100.0	
Are antemortem and postmortem inspections essential to hygiene production	100			
Agree		86(86)	86.0(86.0)	86.0
Disagree		14(14)	14.0(14.0)	100.0
Total		100		
Does eating and drinking in the slaughter area should be disallowed	100			
Agree		53(53)	53.0(53.0)	53.0
Disagree		47(47)	47.0(47.0)	100.0
Total		100	100.0	
Does change or sterilize your knives after each processing good for meat hygiene	100			
Agree		99(99)	99.0(99.0)	99.0
Disagree		1(1)	1.0(1.0)	100.0
Total		100	100.0	
Is slaughtering and processing of meat on a clean slaughter floor comparable to that of the slaughter line	100			
Agree		100(100)	100.0(100.0)	100.0
Disagree				
Total		100	100.0	
Does meat handlers contaminate meat when they are infected with aberrations and wounds	100			
Agree		80(80)	80.0(80.0)	80.0
Disagree		20(20)	20.0(20.0)	100.0
Total		100	100.0	
Does rubbing of meat with fresh blood to make it look good	100			
Agree		8(8)	8.0(8.0)	8.0
Disagree		92(92)	92.0(92.0)	100.0
Total		100	100.0	

### 3.4. Respondent Practice Assessment

Table 3 illustrates the assessment of respondent practices. The results indicate that 99% of respondents washed their clothes daily after work, and 90% did not process carcasses and intestines together in the same location. About 79% of respondents used enough clean water for meat processing, while 21% did not. Additionally, 79% washed their hands

regularly during the workday, whereas 21% did not. Notably, 97% of respondents did not wash their animals before slaughter, and 5% rubbed meat with blood after processing to enhance its appearance. The study found that all respondents did not freeze their meat after processing due to a lack of electricity in the area. Furthermore, more than half (53%) of respondents inspected their animals before slaughter, while less than half (47%) did not.

*Table 3. The Respondent Practice Assessment.*

variable	No	frequency	Percent (%)	Cumulative percent (%)
Do you wash your clothes daily after work	100			
Yes		99(99)	99.0(99.0)	99.0
No		1(1)	1.0(1.0)	100.0
Total		100	100.0	
Do you process carcass and intestine together in the same place	100			
Yes		10(10)	10.0(10.0)	10.0
No		90(90)	90.0(90.0)	100.0
Total		100	100.0	
Do you use enough clean water to process your meat	100			
Yes		79(79)	79.0(79.0)	79.0
No		21(21)	21.0(21.0)	100.0
Total		100	100.0	
Do you wash your hands regularly during the workday	100			
Yes		79(79)	79.0(79.0)	79.0
No		21(21)	21.0(21.0)	100.0
Total		100	100.0	
Do you wash the animal before slaughtering	100			
Yes		3(3)	3.0(3.0)	3.0
No		97(97)	97.0(97.0)	100.0
Total		100	100.0	
Do you rub meat with blood after processing to make it look fresh?	100			
Yes		5(5)	5.0(5.0)	5.0
No		95(95)	95.0(95.0)	100.0
Total		100	100.0	
Do you freeze your meat after processing	100			
Yes				
No		100(100)	100.0(100.0)	100.0
Total		100	100.0	
Do you inspect your animals before slaughtering	100			
Yes		53(53)	53.0(53.0)	53.0



variable	No	frequency	Percent (%)	Cumulative percent (%)
No		47(47)	47.0(47.0)	100.0
Total		100	100.0	

## 4. Discussion

This study aimed to assess the present condition of meat hygiene knowledge, attitudes, and practices and identify the agents related to meat hygiene practices among butchers in Wadi Salih Garsila [21]. Conservation of appropriate meat hygienic practices at the shop while handling is important to supply high-quality and healthy meat for human consumption [22]. According to the high proportion of meat pollution on the butchery side, butcheries play a significant part in preventing meat-borne illnesses; to provide safe and high-quality meat for human consumption, it is important to practice and preserve good hygiene during meat handling [23]. Washing hands by meat handlers during the processing of meat is important to protect meat from contamination [24]. However, meat handlers they were had less knowledge about the risk of food poisoning as well as selected foodborne illnesses and foodborne agents. This is consistent with previous studies that have found meat handlers to be more knowledgeable about hand washing and the use of protective equipment compared to other domains of food safety [25].

The present study revealed that less than half 41% of butchers were above 46 years old, this finding disagrees with a study done in South Africa that showed 10% of butchers were above 50 years old [23], this disagreement may be due to different culture of work. Our study found that the majority of butchers 90% were married this result contrasts with a study done in Iraq that revealed 53.3% of butchers were married [26], this agreement might be due to similar ideas about marriage between this nation. The present study showed that 24% of butchers had 11 to 20 years of butchering experience this finding agrees with a study done in India that revealed 31.67% had above than 10 years of butchering experience [27], this agreement may be due to the same income of this work. Therefore 69% of respondents were uneducated this finding disagrees with the study revealing that 39% had a high school education [28], This disagreement may be due to the different development of communities in this nation.

The study revealed that 99% of butchers think that regular washing of hands reduces the risk of meat contamination and 84% of them think using appropriate gloves reduces contamination. This finding agrees with a study done in Nigeria that showed 95.28% think regular washing of hands reduces the risk of meat contamination and 74.21% of them think using appropriate gloves reduces contamination respectively [1], This agreement might be due to some information on how

to provide high-quality meat. Our study found that about 54% of respondents have proper knowledge of potential contamination sources, this finding disagrees with the study showed that 30.9% of the respondents knew the sources of meat contamination [1]. This disagreement may be due to different awareness about meat contamination sources.

All butchers 100% in this study agree that wearing clean personal protective equipment at work improves meat hygiene, this finding agrees with a study done in Morocco that showed 60% of the abattoir workers used personal protective equipment [2] this agreement may be due to butchers awareness about meat hygiene. In addition to that about 86% of respondents were aware that antemortem and postmortem inspection are essential to hygiene production, this finding disagrees with a study revealed that 72.5% of the respondents were unaware that animals should be inspected before and after slaughtering [29], this disagree might be due to different information about important of inspection between countries. Regarding to washing of equipment, our study showed that 99% of butchers agreed to sterilize their equipment after each processing of meat, this finding disagrees with a study that showed 85.8% of meat workers wash their equipment once time a day [19] this may be due to different culture of work between meat workers. In addition to that more than half 80% of respondents agree that meat handlers can contaminate meat when they are ill with contagious diseases, this finding agrees with a study that showed 69.8% of Food handlers with abrasions or cuts on their hands should not handle food without gloves [13], This agree might be due to dangerous of food-borne disease.

The study showed that more than half 99% of respondents wash their clothes daily after work this finding disagrees with the study showed that 68.2% of participants didn't wash their aprons after each day's work [13]. This disagree may be due to different awareness about meat hygiene between countries. More than half 53% of butchers inspected their animals before slaughtering this finding agrees with a study that revealed that 88.05% of them inspected their animals before slaughtering [1], this agreement may be due to the same information about the importance of inspection. Therefore 79% of respondents used enough clean water to process their meat this finding agrees with the study that showed that 67.5% of them used enough clean water to process their meat [29], this agreement may be due to some awareness about the use of clean water in work to process meat with high quality.



## 5. Conclusion and Recommendations

The present study identified that there is middle information knowledge of meat hygiene, good information about respondents' attitudes toward meat hygiene, and respondent practice assessment. More awareness about food-borne disease, meat safety, and meat source contamination should be provided in the study area to increase the quality of meat hygiene in the study area. Also, veterinary extension should be provided because there is a large number of butchers who don't inspect their animals before slaughtering them due to a lack of veterinary service.

## Abbreviations

SPSS Statistical Packages for Social Sciences  
WHO World Health Organization  
SMEs Small and Medium-sized Enterprises

## Acknowledgments

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## Conflicts of Interest

The authors declare no conflicts of interest.

## Appendix

*Questionnaire Sheet: Assessment of Meat Hygiene Practices in Abattoirs and Markets in Wadi Salih, Central Darfur, Sudan*

### Demographic characteristic of Respondents

- 1/ Gender a- Male ( ) b- female ( )  
2/ Age a- <25 ( ) b- 26 to 35 ( ) c- 36 to 45 ( )  
d- > 46 ( )  
3/ marital status  
single ( ) b- married ( ) c- widowed ( )  
4/ years of experience  
a- < 10 years ( ) b- 11 to 20 ( ) c- 21 to 30 ( )  
d- > 30 years ( )  
5/ Educational level  
a primary school ( ) b- secondary school ( ) c-  
uneducated ( ) d- university ( )

### Knowledge of meat hygiene

- 1/do you think regular washing of hands reduces the risk of meat contamination? Yes ( ) No ( ) I don't know ( )  
2/do you think using appropriate gloves reduces contamination  
Yes ( ) No ( ) I don't know ( )  
3/do you think freezing meat is important for preservation  
Yes ( ) No ( ) I don't know ( )  
4/Do you think washing live animals is important before slaughter?  
Yes ( ) No ( ) I don't know ( )  
6/do you think carcasses can be contaminated in dirty environments?  
Yes ( ) No ( ) I don't know ( )  
7/Do you have Proper knowledge of potential contamination

### Respondents Attitude toward Meat Hygiene

- 1/ Does wearing clean PPE at work improve meat hygiene? Agree ( ) Disagree ( )  
2/does Ante mortem & postmortem inspection essential to hygienic meat production? Agree ( ) Disagree ( )  
3/ Does eating and drinking in the slaughter area should be disallowed? Agree ( ) Disagree ( )  
4/ Does it is important to use clean water to wash working surfaces and instruments after disinfection  
Agree ( ) Disagree ( )  
5/ Does change or sterilize your knives after each processing? agree ( ) Disagree ( )  
6/Does slaughtering & processing of meat on a clean slaughter floor comparable to that of the slaughter Line? Agree ( ) Disagree ( )  
7/does Meat handlers can contaminate meat when they are ill with contagious diseases? Agree ( ) Disagree ( )  
8/Does Rubbing meat with fresh blood to make it look good? Agree ( ) Disagree ( )

### Respondents' Practice Assessment

- 1/Do you wash your clothes daily after work?  
Yes ( ) No ( )  
2/ Do you process carcass & offal/intestine together in the same place? Yes ( ) No ( )  
3/Do you use enough clean water to process your meat? Yes ( ) No ( )  
4/ Do you wash your hands regularly during work say?  
Yes ( ) No ( )  
5/ Do you wash the animals before slaughtering them?  
Yes ( ) No ( )  
6/ Do you rub meat with blood after processing to make it look

Sources? Yes ( ) No ( ) I don't know ( )

8/Do you know Knowledge of cause of foodborne illness

Yes ( ) No ( ) I don't know ( )

9/do you think Meat inspection to rule out infection is Important?

Yes ( ) No ( ) I don't know ( )

fresh? Yes ( ) No ( )

7/ Do you freeze your meat after processing?

Yes ( ) No ( )

8/ Do you inspect your animals before slaughtering?

Yes ( ) No ( )

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