



Food-borne zoonoses in public health: Situational analysis of knowledge and risk behaviours among meat traders in Burkina Faso

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Abstract

This study was conducted to assess the knowledge and practices of meat traders regarding hygiene and the risk of zoonotic infections associated with meat processing in two major urban areas (Ouagadougou and Bobo Dioulasso) of Burkina Faso. A structured questionnaire was developed, and individual face-to-face interviews were conducted with 370 meat traders. The Chi-square and Fisher's exact tests were performed to assess the association between the investigated variables. The results showed that 62% of traders had low knowledge of food hygiene and food-borne zoonoses. The level of knowledge was significantly associated with the level of education and the type of actors involved ($p < 0.05$). In addition, only 27.8% of traders applied adequate hygiene practices to prevent the risk of foodborne zoonoses. Adopting adequate practices was significantly associated with variables like age, education and type of actors involved ($p < 0.05$). In conclusion, the study revealed that the knowledge and practices of the traders were inadequate, exposing consumers to zoonotic infections. This highlights the need for taking actions to improve the standard of hygiene practices in meat outlets.

Keywords: Food safety, Hygiene, Meat, Public Health, Risk behaviours, Zoonoses

Introduction

Zoonoses are diseases and infections that are naturally transmissible from animals to humans and vice-versa (Scialabba, 2022). Globally, they represent at least 60% of infectious diseases, with over 2.5 billion human cases per year (Tomley & Shirley, 2009). About 60% of known infectious diseases that occurred in the last 40 years, affecting humans, were of animal origin (Taylor *et al.*, 2001; Bompard *et al.*, 2020). Latest epidemics of Ebola virus in Africa (2014), Highly Pathogenic Avian Influenza (1959–2023; Charostad *et al.*, 2023) and of COVID-19 pandemic in 2019 (Peng, 2020) have highlighted the increased risk of health emergencies of international concern, and the role of veterinary services in implementing rapid detection and response to zoonotic diseases (Acha & Szyfres, 2005). Among zoonoses, many are of food origin and have high public health, social, and economic impact due to their frequency, severity, and contagiousness (Mekonnen *et al.*, 2021; Roth & Galyon, 2024; Das *et al.*, 2025). Zoonotic diseases are caused by pathogens present in foodstuffs, which can have harmful effects on public health (CDC, 2025). However, these pathogens are often introduced by actors involved in various links of the food chain (Collins & Wall, 2004; Fosse, 2006). Given its protein, vitamin and iron contents, meat is one of the most widely consumed foods (Bohrer, 2017). This food of animal origin is subject to food safety measures and control aiming at preventing the transmission of zoonotic pathogens to consumers (Muchenje *et al.*, 2018). Poor hygiene conditions in the meat processing and distribution processes promote frequent contamination (Fosse, 2006).

Food safety refers to all the measures to be taken to ensure the safety and wholesomeness of food, making sure that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use (WHO, 2022). Failure to comply with these measures can result in the risk of disease transmission to humans via the contaminated foodstuff (Goudiaby, 2005). According to Mohammad *et al.* (2018), unsafe food for human consumption, due to the presence of pathogens, is the cause of nearly 420,000 deaths annually, including many young children. The burden of foodborne disease is particularly high in Africa, where the resulting illnesses and deaths are comparable to those caused by major infectious diseases such as malaria, tuberculosis and HIV/AIDS (Dione *et al.*, 2022).

In Burkina Faso, available data indicated that consumers of poultry meat are exposed to a high risk of contamination, as a result of lack of good practices

in transporting, slaughtering and cooking techniques (Dinede *et al.*, 2023; Assefa *et al.*, 2023). Unfortunately, good hygiene practices are not observed by food handlers throughout the food service chain to avoid the risk of contamination (Compaore *et al.*, 2022). These food-borne infections not only have devastating effects on public health, but also contribute to loss of working time and productivity on farms, medical expenses and other economic costs (Dione *et al.*, 2022). Concerning this background, we are tempted to question the situation of knowledge and practices of meat sellers in terms of hygiene and the risk of food-borne zoonoses transmission. Therefore, this study was conducted to assess the knowledge and practices of meat sellers in terms of hygiene and the associated zoonotic risks.

Material and Methods

Study areas

The study consisted of a cross-sectional survey among meat sellers including grilled meat traders and the butchers in Ouagadougou (12° 21' 56.38" N; -1° 32' 1.97" W) and Bobo Dioulasso (11° 10' 37.74" N; -4° 17' 52.44" W), the two major urban areas hosting up to 62% of the urban population in Burkina Faso (RGPH, 2019; Figure 1), from August to November 2022. The two cities host up to 62% of the urban population in Burkina Faso (Burkina Faso, 2019). They also host the country's two largest modern abattoirs. The annual processing capacities of these abattoirs are estimated at 20,000 tonnes and 7,500 tonnes of meat in Ouagadougou and Bobo Dioulasso, respectively (FAO, 2016).

Sampling and data collection

The study population was the meat traders in the cities of Ouagadougou and Bobo Dioulasso during the study period. Participants were recruited using a snowball sampling method. We used this non-probability sampling method because a formal list of meat vendors was unavailable, given the often-informal nature of this activity. With support from the local livestock service, a first meat trader was identified and interviewed. At the end of each interview, the trader was asked to introduce the investigators to the next closest meat trader in the same area. In total, 370 meat sellers were surveyed in Ouagadougou (n=215) and Bobo Dioulasso (n=155). A structured interview questionnaire with both closed-ended and open questions were used to collect the data through face-to-face interview. In each meat

sales outlet, the questionnaire was administered to a meat trader. The interview was conducted in a language understandable to participants, especially Dioula, French or Mooré. Data collected included traders' sociodemographic and professional characteristics (age, sex, level of study, type of activity, type of traded meat), their knowledge regarding zoonoses (types of zoonoses, transmission circumstances and routes (contamination drivers) and their practices in terms of good hygiene principles (hand washing, meat packaging, and means of meat exposure in the trading site).

Data analysis

Participants' knowledge and practices related to hygiene and zoonotic diseases were assessed using a scoring method based on the completeness and accuracy of their responses. Each response was scored from zero (0) to one (1), where 0 indicated an incorrect or incomplete answer, and 1 indicated a correct and complete answer (Chinchwadkar & Panda, 2020). A total of ten questions were used for the assessment, including five questions on knowledge and five on practices. The sum of the scores obtained for each set of questions was used to classify participants' knowledge and practice levels as follows:

- Knowledge was classified as " low " for total scores ranging from 0 to 1, " moderate " for

scores from 2 to 3, and " high " for scores from 4 to 5;

- Practices were classified as " inadequate " for total scores ranging from 0 to 2, and " adequate " for scores from 3 to 5.

All data analyses were performed using R 3.6.1 software (confidence level of 95%). Sociodemographic data were analysed by determining the frequencies and percentages of the different qualitative sociodemographic variables. A contingency table (2×2) was created to measure the association between each explanatory sociodemographic variable (age, education, type of meat traded, monthly income, type of actors) and the level of knowledge and practices. The Chi-square and Fisher's exact tests were performed, and each sociodemographic variable was significantly associated with the level of knowledge and the practices at a significance level of 5% ($p < 0.05$).

Ethical considerations

This study obtained ethics approval from the Research Ethical Committee of the Université Cheikh Anta Diop (Protocole-0322/2018/CER/UCAD). Prior to the administration of any questionnaire, participants were informed about the background and purpose of the study, highlighting that their participation was voluntary and that all data would be kept anonymised as well as confidential. Therefore, only participants who verbally agreed were interviewed.

Results

Sociodemographic and professional characteristics of the participants

Most of the participants involved in the selling of meat were retail butchers (53%). All the participants were males (100%). Most of the participants (46%) were between 36 and 50 years old. Considering the level of education, 48% of participants had a primary education level, 15% secondary education level, and 36% had no formal education. The meat sold is mainly of bovine origin (57%) versus 29.5% for meat prepared from small ruminants (Table 1).

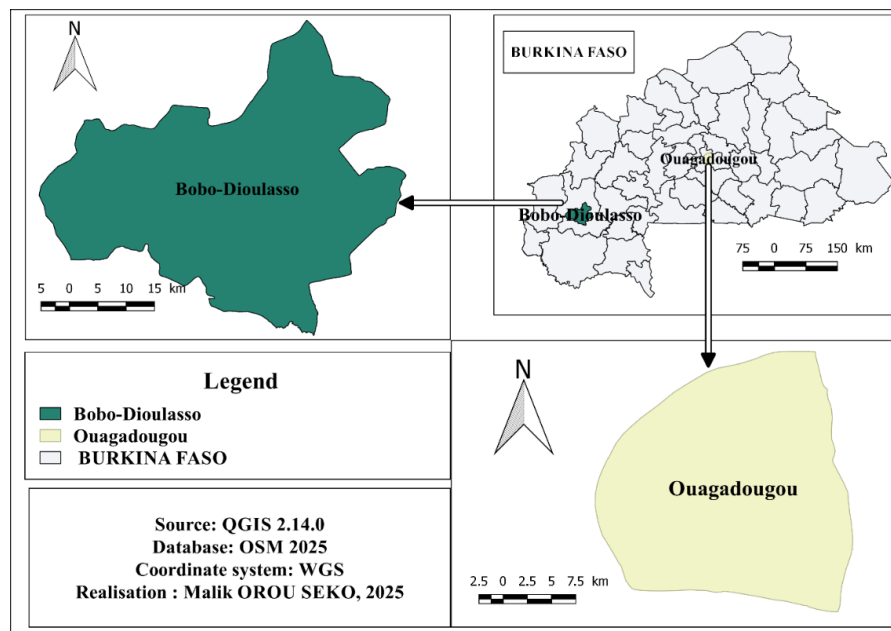


Figure 1: Geographical location of the study sites

Knowledge of good hygiene practices and zoonotic risks associated with meat trading

Up to 84% of meat traders were aware of the possibility of pathogen transmission from products of animal origin to humans (Table 2). According to them, the main circumstances of transmission of these diseases are through their consumption (45%) and the handling (27.84%) of contaminated animal products. However, most of the participants were unable to name at least one food-borne zoonotic disease (77%). Only 23% of participants were able to name zoonotic diseases. Among the mentioned zoonoses, 57% were caused by bacteria (namely anthrax, brucellosis, tuberculosis), 36% by parasites (namely cysticercosis, fasciolosis), and 7% by viruses (rabies, Highly Pathogenic Avian Influenza, Ebola). Regarding preventive behaviours, 58.65% of traders mentioned that hand washing was an effective way of preventing the transmission and spread of zoonoses. Almost all those surveyed were aware that hygiene of facilities (95.19%) and equipment (93.24%) was essential to reduce the risk of meat contamination and of transmission of zoonotic diseases to humans. When asked about the need for capacity strengthening, most of the traders (65.68%) stated that attending awareness-raising and training sessions would be very important for improving their knowledge (Table 2). However, only 23% of the

traders questioned indicated that they had previously attended a training or awareness-raising session related to good practices in the field of meat trading and handling (meat hygiene, processing and storage techniques). According to 43.02% of meat traders, the training or awareness-raising sessions that they attended focused on good hygiene practices. Furthermore, most of the participants (95%) wished to receive any training, for example, on good hygiene practices, technical and economic management of butcherries, and modern meat processing techniques.

Practices of meat traders associated with the supply and retail of meat

Slaughterhouses were the main sources of supply for most of the meat traders surveyed in Ouagadougou and Bobo Dioulasso (83%) (Table 3). Transportation facilities with no cooling equipment (vehicles or motorbikes) were the main means of transporting meat from slaughterhouses to trade sites. Most of the meat traders (96%) explain the rise in meat prices by the security crisis that Burkina Faso has been experiencing for several years. Up to 66% of traders preferred to sell meat per kg, the price ranging from 3.3 to 4.17 US dollars per kg for the bone-in meat category, and between 4.5 and 5 US dollars for the boneless meat category. Fillet was sold at 7.5 US

Table 1: Sociodemographic and professional data of meat traders (n = 370)

Variables	Modalities	Frequency	Percentage
Location	Bobo-Dioulasso	155	41.9
	Ouagadougou	215	58.1
Gender	Male	370	100
	Female	0	0.0
Age (in years)	18 to 35	160	43.2
	36 to 50	170	45.9
	Over 50	40	10.8
	No formal schooling	134	36.2
Education	Primary	177	47.8
	Secondary	57	15.4
	University	2	0.5
	Beef	211	57.0
Type of meat traded	Small ruminants	109	29.5
	Poultry	44	11.9
	Pig	6	1.6
	Less than 50	2	0.5
Estimated monthly income (USD)	50 to 67	36	9.7
	68 to 83	23	6.2
	Over 83	309	83.5
	Wholesale and semi-wholesale butcher	26	7.0
Type of actors	Retail butcher	228	61.6
	Grilled meat trader	53	14.3
	Assistant butcher	60	16.2
	Ambulant butcher	3	0.8

Table 2: Knowledge of meat traders regarding good hygiene principles and zoonotic risks associated with meat trading (n =370)

Variables	Frequency	Percentage
Can diseases be transmitted from meat to humans?		
Yes	312	84.3
No	32	8.6
Do not know	26	7.0
Under what circumstances can meat be a source of disease transmission to humans?		
Consumption of contaminated meat	168	45.4
Handling contaminated animal products	46	12.4
Both	156	42.2
Do you know of any diseases that can be transmitted to humans from meat?		
At least one zoonosis cited	85	22.9
No zoonoses cited	285	77.0
Does personal hygiene reduce the risk of zoonotic contamination from meat?		
Yes	353	95.2
No/do not know	17	4.8
Does the hygiene of facilities and equipment reduce the risk of zoonotic contamination from meat?		
Yes	345	93.2
No/do not know	25	6.7
Do you think it's important to train sales staff in good hygiene practices?		
Yes	334	90.3
No/do not know	22	5.9
Have you attended an awareness-raising and/or training session on meat-related health risks?		
Yes	84	22.7
No	269	77.3
Do you need training (food safety and hygiene) to improve your business?		
Yes	351	95.0
No	19	5.0
Do you think a lack of hygiene can reduce customer numbers?		
Yes	219	59.2
No	151	40.8

dollars. Regarding the quality of the meat, the majority of traders declared that they did not sell meat from suspected sick animals or cachectic animals (84%). With regard to storage practices, most of the meat traders declared that they were equipped with suitable facilities such as refrigerators (33%) or freezers (55%). Wooden tables were used by 88% of traders to display meat to customers, while only 12% of them were able to use refrigerated or non-refrigerated glass for this purpose. A piece of wood was used as a support for cutting meat in 97% of cases. Reportedly, the frequency of table cleaning was once a day for 69% of meat traders. Plastic bags were used by 73% of traders for meat packaging. Only 24% and 3% of traders used cartoned bags and aluminium foil to package meat for customers, respectively. In addition, customers could handle and manipulate carcasses before purchase at almost half (50%) of sales outlets (Table 3).

Personal hygiene practices in sales outlets

In retail outlets, with respect to personal hygiene, wearing items such as rings and watches was a

frequent behaviour (50.27%). Up to 77.03% of meat traders owned one or two work dresses, while 78.61% did not have an apron. In retailing outlets, workers used soapy water (46.26%) or plain water (28.57%) for hand washing. Hand washing was reportedly practised before and after handling meat (48.65%), only before handling meat (28.11%), and only after using the toilet (12.97%). In 92.78% of retailing outlets, the salespersons also acted as cashiers. The majority of the meat retailing outlets were enclosed facilities (69.2%). Reportedly, 71.35% of these outlets were cleaned once or twice a day, while 25.40% had no fixed cleaning schedule. In 52.42% of cases, soapy water was used for the cleaning purpose (Table 4).

Factors associated with the meat traders' levels of knowledge

Overall, 62.16% of interviewed traders have a low level of knowledge regarding food safety principles, hygiene and zoonotic risks associated with meat trading. Only 11.08% of them have a high level of knowledge (Table 5). The level of school education

Table 3: Practices of traders associated with supply and retail of meat (n = 370)

Variables	Modalities	Percentage
Main source of meat supply	Slaughterhouses	82.9
	Others	17.1
Meat transportation facilities	Cooling equipment	0.0
	No cooling equipment	100.0
Reasons for price increases	Security crisis	94.9
	Sanitary crisis	5.1
Meat sales method	Per kilogram	65.9
	By piece	34.1
Means used to store meat	Refrigerator	32.9
	Freezer	54.9
Sale of meat from sick or cachectic animals	Non-refrigerated equipment	12.2
	Yes	15.1
Meat presentation medium	No	84.9
	Wooden tables	87.8
Meat cutting support	Glass equipment	12.2
	Wooden table or piece	97.0
Frequency of cutting/exposure table cleaning	Food-grade bar	3.0
	Once a day	68.9
Type of packaging used for meat	Twice a day	20.8
	As soon as the table is dirty	10.3
Possibility for customers to handle meat in sales outlets	Plastic bags	72.9
	Cartoned bags	24.0
	Aluminium wrapping foil	3.1
	Yes	50.0
	No	50.0

Table 4: Hygiene practices described in the meat sales outlets (n = 370)

Variables	Percentage
Wearing objects (rings, bracelets and watches) while handling meat	
No	49.7
Yes	50.3
Presence of means of protection (glass or plastic) to reduce the risk of meat contamination in sales outlets	
Yes	100
No	0
Presence of a pay cashier (not authorized to handle meat)	
Yes	7.2
No	92.8
Number of work clothes available	
1 to 2	77
Over 2	23
Wearing of aprons by sales staff	
Yes	21.4
No	78.6
Means of disinfection used for hand washing	
Water only	28.6
Soapy water	46.2
Piece of cloth with soap	25.2
Hand washing frequency	
Before handling meat	28.1
Before and after handling meat	48.7
After using the toilet	12.9
Occasional	11.3

Table 5: Factors associated with the level of knowledge regarding food hygiene and zoonotic risks associated with meat trading (n=370)

Variables	Number	Level of knowledge (%)			p-value
		Low	Moderate	High	
Age (in years)					
18 to 35	160	22.7	12.9	7.6	0.080
36 to 50	170	38.6	5.1	2.2	
Over 50	40	0.8	8.6	1.3	
Education					
No formal schooling	134	21.3	12.2	2.7	0.001*
Primary	177	39.2	4.3	4.3	
Secondary	57	1.6	9.7	4.0	
University	2	0	0.5	0	
Type of meat traded					
Pig	6	0.5	1.1	0	11.48
Poultry	44	0.2	11.6	0	
Small ruminants	109	22.7	2.9	3.8	
Beef	211	38.6	11.1	7.3	
Estimated monthly income (USD)					
Less than 50	2	0.5	0	0	0.200
50 to 67	36	5.4	3.5	0.8	
68 to 83	23	0.8	3.2	2.1	
Over 83	309	55.4	0.2	8.1	
Type of actors					
Wholesale and semi-wholesale butcher	26	5.6	1.3	0	0.003*
Retail butcher	228	30.8	21.8	8.9	
Grilled meat trader	53	11.6	0.8	1.8	
Assistant butcher	60	13.5	2.4	0.2	
Ambulant butcher	3	0.5	0.2	0	

*: significant for $p < 0.05$ (Chi-square and Fisher's exact tests)

and the type of activity was significantly associated with the level of knowledge regarding good hygiene principles and zoonotic risks associated with meat trading ($p < 0.05$). Age of meat traders, type of meat retailed and level of income were not associated with the level of knowledge ($p > 0.05$).

Factors associated with the meat traders' practices as it relates to food safety

Only 27.84% of meat traders demonstrated adequate practices in terms of hygiene in their outlets. Variables like age of meat traders, their level of school education and the type of activity were significantly associated with the practices ($p < 0.05$) (Table 6).

Discussion

Appropriate knowledge of food-borne zoonoses and adequate practices regarding food safety principles are essential to ensuring the safety and quality of meat for secure human consumption. The study showed that most of the meat traders were males, with most of them aged between 18 and 35 years (43%), and between 36 and 50 years (46%), indicating

that meat trading was quite an attractive business for young people. The exclusive presence of males in this field can be explained by the fact that butchery is a physically demanding activity, especially for handling and processing of the meat. Studies conducted in Ghana by Mahaboubil-Haq & Adzitey (2016) and Adzitey & Anachinaba (2015), in South Africa by Rani *et al.* (2017), previously reported a higher number of men in meat processing activities compared to women; this study further corroborates their submission.

The survey indicated that beef was the most represented in retail outlets. This high proportion of beef meat traders can be explained by its lower cost compared to small ruminants and by the fact that it may provide higher financial benefit to traders. Similar findings were reported in Ghana by Adzitey *et al.* (2020). According to this study, most of the meat retailing outlets sold beef, because marketing it was more profitable compared to other animal species. In addition, Belco *et al.* (2017) also reported that selling beef allowed people in Benin to address several socio-economic needs, improving the living

Table 6: Factors associated with the practices regarding food hygiene and zoonotic risks associated with meat trading

Variables	Number	Practices (%)		
		Inadequate	Adequate	p-value
Age (in year)				
18 to 35	160	33.8	9.4	0.000*
36 to 50	170	28.6	17.2	
Over 50	40	9.7	1.1	
Education				
No formal schooling	134	33.8	2.4	0.001*
Primary	177	23.8	24.0	
Secondary	57	14.6	0.8	
University	2	0	0.5	
Type of meat traded				
Pig	6	1.6	0	0.400
Poultry	44	10.0	1.9	
Small ruminants	109	25.9	3.5	
Beef	211	34.5	22.4	
Estimated monthly income (USD)				
Less than 50	2	0.5	0	0.070
50 to 67	36	4.6	5.1	
68 to 83	23	3.2	2.9	
Over 83	309	63.8	19.7	
Type of actors				
Wholesale and semi-wholesale butcher	26	5.9	1.1	0.000*
Retail butcher	228	44.6	17.0	
Grilled meat trader	53	12.7	1.6	
Assistant butcher	60	8.4	7.8	
Ambulant butcher	3	0.5	0.2	

*: significant for $p < 0.05$ (Chi-square and Fisher's exact tests).

conditions of meat traders.

The survey indicated that only about a quarter of participants had received training in the field of meat trading. Nevertheless, when asked about the health risks associated with food, most traders were aware that contaminated meat can cause illness in consumers. This indicates that knowledge was acquired from real-life situations, highlighting the need for engaging communities in investigations to assess the risks of zoonotic transmission associated with products of animal origin. Meat traders were able to name examples of zoonotic diseases such as tuberculosis, brucellosis, highly pathogenic avian influenza, and anthrax. However, when it comes to zoonotic diseases transmitted through food consumption and handling, none of the participants was able to name at least one. These findings are consistent with situations described by Otupiri *et al.* (2000) in Ghana, Besbes *et al.* (2003) in Tunisia, and Alam *et al.* (2020) in Bangladesh. This low level of knowledge among meat traders could be explained by the lack of awareness-raising initiatives, and the low level of study described among the meat traders

during the survey, reducing their literacy on health and preventive measures.

Most of the traders obtained their meat from abattoirs. However, some outlets were supplied from an illegal slaughtering method. By escaping sanitary controls, this type of meat constitutes a health risk to consumers. In these informal markets, which are inaccessible to veterinary services, no pre- or post-mortem sanitary inspection is conducted. In general, meat from slaughterhouses is distinguished by the presence of the stamp, considered by the majority of informed consumers to be proof of the safety and quality of the meat. This observation is in accordance with the results obtained by Sulleyman *et al.* (2018), who reported that meat traders in the Accra metropolis sourced their meat mainly from the abattoir. The results indicated that most of the time, meat was displayed on wooden tables (88%), exposing it to dust, vehicle smoke, flies and other harmful agents. This practice was also very commonly described in Dakar as a marketing strategy used by meat sellers to show consumers how fresh the meat was (Orou Seko *et al.*, 2021). Under these conditions,

meat deteriorates rapidly and may be a source of transmission of foodborne disease to consumers (Abebe *et al.*, 2020). In addition, the wearing of personal protective equipment when handling foodstuffs is very much neglected by the traders. Adzitey *et al.* (2020) also reported that most meat traders in Tamale Metropolitan did not wear an apron during work. The study revealed that meat traders wear objects such as rings, bracelets or watches while working, which also corroborates the report by Bhattarai *et al.* (2017) in Nepal. Such practices should be discouraged, as such objects can serve as sources of cross-contamination with meat. Finally, the study revealed that a few vendors did not use suitable storage facilities (12%). In contrast, a study conducted in Côte d'Ivoire showed that the majority of meat traders stored their meat at room temperature because of a lack of adequate means of storage (Kouassi *et al.*, 2012).

According to the report of Jianu & Goleţ (2014), the study showed that traders' level of knowledge was significantly associated with their level of education. Participants with no formal schooling and those with primary education were more likely to have low knowledge of hygiene and zoonotic risks associated with meat. Regarding the type of actors involved, the lowest levels of knowledge about hygiene and zoonotic risks were much more associated with retail butchers and grilled meat traders. Inadequate practices were significantly associated with a number of factors, including age, education and type of actors. The youngest traders (18 to 35 years old) and those with the lowest level of education (no formal schooling and primary level) were more likely to present inadequate practices. Previous studies reported a significant association between meat traders' hygiene-related practices and their education and age (Jianu *et al.*, 2014; Stratev *et al.*, 2017). Finally, the study highlighted the need for better organisation of meat marketing to safeguard the health of traders and consumers, in view of the public health issues at stake.

In conclusion, the study showed that most of the meat traders were not informed about zoonotic diseases transmissible through animal foodstuffs. In addition, a high proportion of participants had poor knowledge of hygiene and zoonotic risks associated with meat handling. This low knowledge was significantly associated with the level of education and the type of actors. Moreover, most meat traders had inadequate practices in terms of hygiene and zoonotic risks associated with meat handling. Inadequate practices were significantly associated

with age, education, and the type of actors. The study findings suggest the need for taking the actions to improve the standard of hygiene practices in meat outlets, which include developing a communication and sensitisation strategy, including practical aspects such as hygiene, transmission of food-borne zoonoses, personal protection, and standards for meat storage. Secondly, the elaborate and disseminated guidelines for monitoring compliance with meat sales standards in outlets. Lastly, the reinforcement of the application of food safety and veterinary public health regulations in the domain of meat trading.

However, considering the risks of transmission and spread of food-borne pathogens, meat handlers or traders should be equipped with good knowledge and skills for implementing food safety measures and principles. To do so, continuous training on food safety is needed for all actors intervening in the value chain.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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