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SHORT COMMUNICATION

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Knowledge and practices regarding Middle East Respiratory Syndrome Coronavirus among camel handlers in a Slaughterhouse, Kenya, 2015

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Abstract

Dromedary camels are implicated as reservoirs for the zoonotic transmission of Middle East Respiratory Syndrome coronavirus (MERS-CoV) with the respiratory route thought to be the main mode of transmission. Knowledge and practices regarding MERS among herders, traders and slaughterhouse workers were assessed at Athi-River slaughterhouse, Kenya. Questionnaires were administered, and a check list was used to collect information on hygiene practices among slaughterhouse workers. Of 22 persons, all washed hands after handling camels, 82% wore gumboots, and 65% wore overalls/dustcoats. None of the workers wore gloves or facemasks during slaughter processes. Fourteen percent reported drinking raw camel milk; 90% were aware of zoonotic diseases with most reporting common ways of transmission as: eating improperly cooked meat (90%), drinking raw milk (68%) and slaughter processes (50%). Sixteen (73%) were unaware of MERS-CoV. Use of personal protective clothing to prevent direct contact with discharges and aerosols was lacking. Although few people working with camels were interviewed, those met at this centralized slaughterhouse lacked knowledge about MERS-CoV but were aware of zoonotic diseases and their transmission. These findings highlight need to disseminate information about MERS-CoV and enhance hygiene and biosafety practices among camel slaughterhouse workers to reduce opportunities for potential virus transmission.

KEYWORDS

biosafety, camel, Middle East respiratory syndrome, slaughterhouse

1 | INTRODUCTION

Middle East respiratory syndrome coronavirus (MERS-CoV) was first recognized as a cause of severe human respiratory disease in 2012 (Zaki, Van Boheemen, Bestebroer, Osterhaus, & Fouchier, 2012). By July, 2018, there were over 2,200 cases in humans globally, 35% being fatal, mainly from Arabian Peninsula (WHO, 21, July 2018). Although the geographic source of MERS-CoV remains poorly understood, increasing evidence indicates that dromedary camel is a host species for the virus and plays a role in transmission to humans (Reusken et al., 2014). High prevalence of MERS-CoV antibodies in dromedaries in Africa and Arabian Peninsula was demonstrated from sera archived between 1992 and 2012 (Corman et al., 2014; Reusken et al., 2014). Phylogenetic analysis of camel-derived and human-derived sequences from Oman, Qatar and Saudi Arabia

The work was carried out: Data collection—Athi-river slaughter house, Kenya.

match suggested zoonotic transmission (Briese et al., 2014; Reusken et al., 2014).

MERS-CoV ribonucleic acid (RNA) has been detected in camel nasal, oral, fecal specimens and in air samples in a barn that held an infected camel (Azhar et al., 2014). The MERS-Co virus is thought to be transmitted from the nasal mucosa and conjunctiva of infected camels, especially through respiratory secretions because viral load has been found to be high in these sites (Azhar, El-Kafrawy, et al., 2014). Camels have been reported to be infected simultaneously with more than one MERS-CoV and re-infection and viral shedding of camels previously infected with the virus had been reported (Farag et al., 2015). This makes those exposed to camels potentially at an elevated risk of exposure compared to the general population.

Persons with possible occupational exposure include herders, traders and slaughterhouse personnel. Slaughterhouse workers have been demonstrated to be at an elevated risk of MERS-CoV exposure relative to the general population (Muller et al., 2015). High viral loads have been found in camels in slaughter houses suggesting that they are places of high MERS-CoV circulation and a high-risk area for human exposure (Farag et al., 2015). An investigation in Egypt, using real-time polymerase chain reaction (RT-PCR) detected MERS-CoV in 3.6% (4 of 110) apparently healthy dromedary camels in a slaughterhouse mainly in camels that had been imported from Sudan or Ethiopia (Chu et al., 2014). The World Health Organization recommends use of hand and face protection as protection for people working in slaughterhouses. The International Health Regulations relies on rapid national detection and containment of public health threats. Our study sought to assess hygiene and biosafety knowledge and practices among herders, traders and slaughterhouse workers.

Impacts

- Our results documented low knowledge of MERS among herders, traders and slaughterhouse workers.
- Abattoir workers were unaware of hand and face protection as ways of protecting themselves from exposure to MERS.
- Herders and slaughterhouse workers were aware of zoonotic diseases which could potentially reduce opportunity for potential virus transmission.

2 | MATERIALS AND METHODS

2.1 | Study design, study area and population

We assessed biosafety measures undertaken by the slaughterhouse workers which included washing of hands, use personal protective equipment and knowledge of MERS. We also assessed whether they had knowledge of zoonotic diseases and ways in which they are spread. The study was carried out in Athi-river slaughter house which is in Machakos, Kenya, 20 km southeast of Nairobi.

2.2 | Sampling

All slaughterhouse workers, herders and traders met at the slaughterhouse were interviewed as a convenience sample.

2.3 | Data collection

A standardized pre-tested questionnaire was used to collect data from participants about MERS-CoV ("camel flu" in Kiswahili) to assess knowledge of MERS and other zoonotic diseases. A check list was used to collect information about hand-washing practices after handling camels and use of personal protective equipment.

2.4 | Data entry and analysis

Data from questionnaires were entered, cleaned and analyzed using EPI Info 7 (CDC, Atlanta, GA). Descriptive statistics were calculated for categorical variables including occupation, hand-washing practices, use of personal protective equipment, and knowledge of MERS and zoonotic diseases among slaughterhouse workers, herders and traders.

2.5 | Ethical approval and considerations

Ethical approval was obtained from Jomo Kenyatta University of Agriculture and Technology (JKUAT) and Kenya Medical Research Institute (KEMRI) Scientific and Ethical Review Committee. Permission to conduct the study was sought from Director of Veterinary Services, County Director and slaughterhouse management. Consent was obtained from the herders for interviews and specimen collection.

3 | RESULTS

Twenty-two people who included five herders/traders, 14 slaughter house workers, two meat inspectors and one County supervisor were interviewed. Majority were aged between 31 and 50, and 10 (45.5%) had a Secondary school education. Fourteen (64%) participated in slaughter, and 18 (82%) had worked in the slaughter house for more than 3 years (Table 1). Of these, 82% wore gumboots (100% among slaughterhouse workers), 65% wore overalls/dustcoats (88% among slaughterhouse workers). All persons interviewed reported washing hands after handling camels. None reported use of hand gloves or face masks during slaughter. Less than one-third (27%) of the respondents had heard about MERS, but majority (90%) were aware diseases could be transmitted from animals to humans, common ways being through eating improperly cooked meat (90%), consumption of raw milk (68%) and slaughter processes (50%). Three herders (14%) reported drinking raw camel milk.

4 | DISCUSSION

All of the herders and slaughterhouse workers had good hygiene practices which were demonstrated by washing of hands after the

TABLE 1 Characteristics, knowledge, attitude and practices regarding MERS among herders, traders and slaughterhouse workers at Athi-river slaughterhouse, 2015

Characteristics	Response	Frequency (*n*)	Percentage (%)
Age in years	18–30	9	41
	31–50	10	46
	Over 50	3	14
Level of education	Islamic Religious	2	9
	Primary	6	27
	Secondary	10	46
	College	4	18
Nature of work	Slaughter	14	64
	Herder/trader	5	23
	Meat inspection	2	9
	Supervision	1	5
No. of years worked	1–3	4	18
	Over 3 years	18	82
Heard about MERS in camels or humans	Yes	6	27
	No	16	73
Disease can be transmitted from animals to man	Yes	20	91
	No	0	0
	Don't know	2	9
Ways of disease transmission	Eating improperly cooked meat	20	91
	Drinking raw milk	15	68
	Slaughtering animals	11	50
	Contact with vaginal discharges	7	32

slaughter process or after handling camels. Slaughterhouse workers were also aware of the importance of using protective clothing while handling camels during slaughter, but the use was limited to use of footwear and labcoats/overalls suggesting that they were mainly protecting themselves from dirt. Use of personal protective clothing to prevent direct contact with discharges and aerosols was observed to be low since there was no use of gloves and face masks. As knowledge of camel herders and slaughterhouse workers on MERS-CoV was lacking, these findings provide possible higher-risk activities during slaughter. Slaughterhouse workers' awareness of zoonotic diseases and their transmission was high enabling them to protect themselves from exposure. Three herders reported drinking raw camel milk, which increases overall risk of exposure to zoonosis.

Recent studies carried out in Kenya have shown a persistently high level of MERS-CoV antibodies in camels. In a study carried out in a single county in Kenya, 47% of camels were found to have antibodies (Deem et al., 2015). Another study carried out in Marsabit County showed over 90% sero-prevalence among camels, but none of the humans tested showed presence of antibodies (Munyua et al., 2017). The true incidence of MERS-CoV infections in humans may not actually be known, as most patients could be asymptomatic or present with symptoms similar to influenza, the common cold or other infections known to cause respiratory disease. Antibodies against MERS have been demonstrated in Kenya in two people in an area that has a high camel density (Liljander, et al., 2016). In 2015, in a slaughterhouse in Nigeria, sero-prevalence of mature camels coming for slaughter was found to be 95% (Chu et al., 2015).

Due to limited of funding, herders and slaughterhouse workers were not tested for MERS-CoV antibodies to assess putative MERS-CoV transmission from dromedaries to humans. These findings would provide insights into an actual risk of infection in slaughterhouses and could provide an opportunity for further research. In addition, a small number of herders, traders and slaughterhouse workers were enrolled therefore limiting identification of significant differences in the knowledge, practices and beliefs and results may not be generalizable to other traders and herders in Kenya. The low enrollment was because slaughter took place at night and camels were sold to traders back at home. Traders delivered camels to the slaughterhouse and left them in the care of the slaughterhouse workers. Despite these limitations, this study provides useful qualitative information on camel handling and slaughter practices.

5 | CONCLUSION

While neither the infection status in persons working with camels nor the risk of transmission was evaluated, studies have indicated that slaughterhouse workers are at an elevated risk of exposure

relative to the general population (Muller et al., 2015). A study conducted in Marsabit County, Kenya, showed that despite 90% seroprevalence among camels, there was no serological evidence of MERS-CoV exposure among pastoralists, suggesting localized MERS virus transmission patterns (Munyua et al., 2017). Further evaluation of exposure status among persons working with camels would inform development of surveillance and prevention guidelines. This study emphasizes the lack of knowledge about MERS-CoV among slaughterhouse workers. Public health authorities should therefore provide more information to sensitize slaughterhouse workers about MERS and other emerging zoonotic diseases to enable them to better protect themselves to reduce opportunities for potential virus transmission. Biosafety practices for persons who have occupational exposure to camels should be evaluated. Understanding the epidemiology of MERS-CoV in Kenya including transmission and exposure in camels and in persons with occupational exposure to camels will contribute to targeted surveillance, more rapid detection and control of MERS-CoV in Kenya, thereby enhancing global health security.

6 | DISCLAIMER

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORS' CONTRIBUTIONS

Esther Kamau: conception and design, data acquisition, data analysis and interpretation, drafting, revision and final approval of the manuscript. Juliette Ongus: conception and design, data analysis and interpretation and final approval of the manuscript. George Gitau: data interpretation and final approval of the manuscript. Tura Galgalo and Peninah Munyua: conception and design, data interpretation, drafting, revision final approval of the manuscript. Sara Lowther: data interpretation, revision of the article and final approval of the manuscript. Austine Bitek: conception and design of the study and final approval of the manuscript.

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