Asymptomatic and subclinical infection of MERS-CoV in persons at the human-camel interface in Saudi Arabia

Khawater Bahkali[a,b], Ahmad Albarrag[b] , Samy Kasem[c], Ali Al-Hufofi[d], Ali Al-Doweriej[c], Emad Almohammadi[b] , Haleemah Alserehi[e], Patrick Nguipdop-Djomo[a], Punam Mangtani[a], Jimmy Whitworth[a], Ada Al-Qunaibet[b]

[a] Department of Infectious Disease Epidemiology, Faculty of Epidemiology and Population Health, London School of Hygiene & Tropical Medicine, London, United Kingdom. [b] The Saudi Public Health Authority , Riyadh, Saudi Arabia. [c] The National Centre for the Prevention and control of plants, pests and animal diseases, Saudi Arabia [d] Department of Veterinary Laboratory, Ministry of Environment, Water and Agriculture, Saudi Arabia [e] General Directorate of Communicable Diseases Control, Ministry of Health, Saudi Arabia.

Background

o MERS-CoV is a zoonotic virus circulating in camels that causes no noticeable illnesses, yet in humans, it can cause severe disease. [1]

o Transmission is well-documented between humans and animals, yet not human to human, aside from previous outbreaks in healthcare settings, and a constant portion of primary human cases not connected to camels.. [2]

o Since the SARS-CoV-2 pandemic, there have been suggestions that camels may be at risk of SARS-CoV-2.[3]

Aim

To investigate if MERS-CoV can be silently carried by individuals in contact with camels, potentially leading to transmission to people without direct camel exposure.

Objectives

o To measure the prevalence of MERS-CoV using PCR and ELISA in individuals with both direct and indirect contact with camels, and their camels.

o To investigate if SARS-CoV-2 had spilled over from humans to camels.

Methodology

o A cross-sectional study in the central region of Saudi Arabia, between November 2022 and March 2024, in multiple settings at the human-camels interface. Two populations were included:

1. People who have direct (Physical contact, either occupational or recreational) or indirect (being within 10 meters of camels) contact with camels.

2. People who have contact with camel contacts i.e. people in point 1, at least monthly.

o Participants were interviewed in person about demographic and health data, details of contacts with camels and daily contact patterns with people at home, work, etc.

o Sampling was sequential in racetracks, abattoirs, the festival and the OPD, random start then sequential in markets and convenience in a VET clinic.

o Nasal swabs and blood samples were collected from humans and camels; swabs were assayed for MERS-CoV and SARS-CoV-2 nucleic acids by RT-qPCR, and bloods were tested for IgG antibodies against MERS-CoV and SARS-CoV-2 by ELISA.
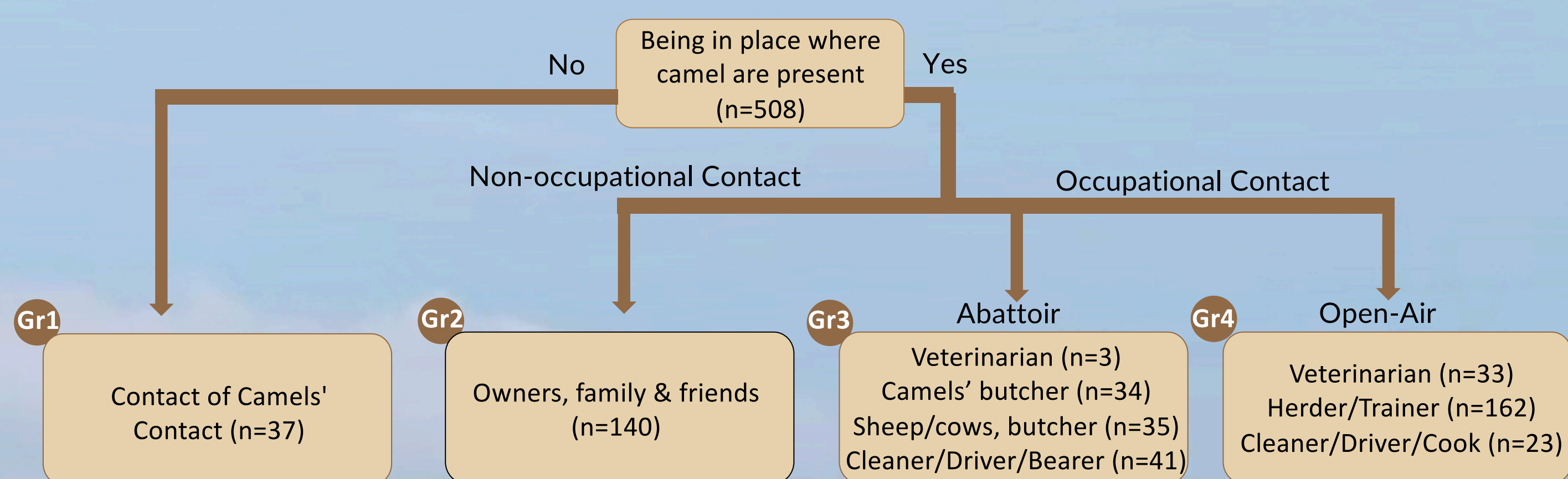

Figure 1. Flowchart of the study population groups based on the presence around and physical contact with camels.

References
1. Memish, Z. A., Perlman, S., Van Kerkhove, M. D. & Zumla, A. Middle East respiratory syndrome. Lancet 395, 1063-1077,(2020).
2. Khudhair, A. et al. Risk Factors for MERS-CoV Seropositivity among Animal Market and Slaughterhouse Workers, Abu Dhabi, United Arab Emirates, 2014-2017. Emerg Infect Dis 25, 927-935,(2019).
3. El Masry, I. et al. Serological evidence of SARS-CoV-2 infection in dromedary camels and domestic bovids in Oman. Emerg Microbes Infect 12, 2220577,(2023).

Results

Table 1. Prevalence of MERS-CoV and SARS-CoV-2 RNA and antibodies in camels by age

Assay	Age category	Setting			
		Abattoir d/N (%)	Market d/N (%)	Enclosure d/N (%)	Race/Festival d/N (%)
Anti-MERS-CoV Abs	<1 year	24/30 (80)	30/34 (88.2)	10/20 (50)	6/8 (75)
	1-2 years	5/5 (100)	10/10 (100)	3/4 (75)	11/15 (73.3)
	>2 years	1/1 (100)	79/80 (98.8)	38/38 (100)	46/46 (100)
	Total	30/72 (41.7)	125/254 (49.2)	53/126 (42.1)	82/160 (51.3)
MERS RNA	<1 year	43/46 (93.5)	17/36 (47.2)	15/39 (38.5)	1/8 (12.5)
	1-2 years	16/18 (88.9)	4/10 (40)	0/4	0/12
	>2 years	5/7 (71.4)	35/83 (42.2)	6/56 (10.7)	0/44
	Total	64/71 (90.1)	57/135 (42.2)	22/101 (21.8)	1/74 (1.4)

➤ SARS-CoV-2 RNA was not found in nasal swabs from 381 camels.

➤ No anti-SARS-CoV-2 antibodies were found in sera from 321 camels.

Table 2. Characteristics of human study population

Variable	Gr1: No contact (n=37)	Gr2: Non occupational (n=140)	Gr3: Occupational (Abattoir) (n=113)	Gr4: Occupational (Open-air) (n=218)
	n (%)	n (%)	n (%)	n (%)
Age (years), Median (IQR)	34 (17.5)	37 (15)	35 (12)	33 (15)
Age categories				
13_39	24 (69%)	76 (54.3%)	81 (71.7%)	144 (66.1%)
40_59	10 (29%)	49 (35%)	29 (25.7%)	65 (29.8%)
>60	1 (2.8%)	12 (8.6%)	3 (2.7%)	5 (2.3%)
Sex				
Female	14 (37.8%)	10 (7.1%)	0	0
Male	23 (62.2%)	130 (92.9%)	113 (100%)	218 (100%)
Nationality				
Saudi	28 (75.7%)	100 (81.3%)	1 (0.9%)	29 (14.1%)
Non-Saudi	9 (24.3%)	23 (18.6%)	112 (99.1%)	176 (85.9%)
Covid-19 Vax (≥1 dose)				
No	1 (4.2%)	9 (7.8%)	2 (1.8%)	45 (23%)
Yes	23 (95.8%)	105 (92%)	107 (98.2%)	151 (77%)

Table 3. Prevalence of MERS-CoV RNA and anti-MERS antibodies in humans

Contact with camels	PCR (orf1)		S1 IgG Abs			
			ODR ≥ 1.1		ODR ≥ 0.5	
	n/N	% (95% CI)	n/N	% (95% CI)	n/N	% (95% CI)
Gr1: No contact	0/21	---	2/36	5.6 (0;13)	9/36	25 (10.9;39.1)
Gr2: Non occupational	0/113	---	1/122	0.8 (0;2.4)	23/122	18.9 (11.9;25.8)
Gr3: In Abattoir	2/113*	1.8 (0;4.2)	4/113	3.5 (0.1;6.9)	50/113	44.2 (35.1;53.4)
Gr4: In Open-air	2/204*	1 (0;2.3)	6/187	3.2 (0.7;5.7)	33/187	17.6 (12.2;23.1)

Note: *The PCR Ct values for the 4 samples were between 37 and 39 cycles (Orf gene), when repeated with new extractions from original samples, for both MERS (E & Orf gene), only one detected at Ct 37 in Gr 4.

Conclusion

o 13 and 115 out of 508 individuals were identified with MERS-CoV exposure or past infection using ELISA cutoffs of 1.1 and 0.5 respectively.

o However, cross-reactivity with SARS-CoV-2 needs to be ruled out by confirmatory neutralization test.

o RNA detection was confirmed in one individual (CT=37) and probable in three others worked with camels, none of them had severe symptoms in the previous two weeks.

Limitations

o Serology cutoffs challenges: higher cutoffs reduce sensitivity, lower cutoffs reduce specificity, leading to false positives.

o PCR results might underestimate prevalence, lower respiratory samples are more accurate than upper ones, especially in mild infections.

o Non-random sampling and clustering requires caution in interpreting representativeness .

POSTER DESIGN