



Factors Associated with Rift Valley Fever in the Health District of Tchintabaraden in the Tahoua Region, Niger, 2016: A Case-Control Study

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Abstract

Background: Following the reporting of animal cases of Rift Valley Fever in Tchintabaraden, Niger, we conducted a study to identify disease risk factors.

Methods: An unpaired case-control study was conducted. A case of Rift Valley Fever was defined as anyone living in Tchintabaraden with a fever (temperature $\geq 38.5^{\circ}\text{C}$), with a gastrointestinal, vaginal, mucuous or nose bleeding, between August 2 and October 31, 2016. A control was a person living in Tchintabaraden without any symptoms of Rift Valley Fever at the time of the study. Proportions and Odds ratios were calculated.

Results: The study included 84 cases and 168 controls.. Compared to controls, a case was associated with the consumption of milk cheese from a sick animal [OR = 2.8, 95%CI (1.4-5.4), $p \leq 0.001$], the consumption of meat from a sick animal [OR = 2.9, 95%CI (1.2-6.6), $p = 0.04$] and contact with sick animals [OR = 2.7, 95%CI (1.5-5.1), $p = 0.01$].

Conclusion: Consumption of dairy products, meat and contact with sick animals were factors associated with the disease. We recommend community outreach on the consumption of sick animal products.

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Keywords: Rift valley fever; Tchintabaraden; Risk factors.

Introduction

Rift Valley Fever (RVF) is an acute, febrile viral disease caused by the Rift Valley Fever Virus (RVFV), a Phlebovirus from the Bunyaviridae family, endemic in sub-Saharan Africa [1,2]. The virus can be transmitted to humans mainly through direct contact with infected animals (sheep, cattle, goat and camels), consumption of raw milk, handling of animal tissues during slaughter or butchering, assistance with the birth of animals,

veterinary procedures or the disposal of carcasses or foetuses [3-5]. Some professional groups such as breeders, farmers, slaughterhouse workers and veterinarians are therefore at greater risk of infection from the handling of meat and body fluids and from the consumption of raw milk [6-9]. Age [3,10,11], being male [10,12] and contact with or transporting aborted animals [6,13,14] are also found to be associated with RVF.



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In Niger, on August 2, 2016, the Sanitary District (SD) of Tchintabaraden located in the Tahoua region reported cases of fever with a hemorrhagic syndrome in humans, the majority of which progressed to deaths mainly at the community level. These cases occurred among herders' families living around the great valleys of the village of Egawane particularly the Maya Valley (5 km from the town of Egawane) in the Tahoua region. The cases that were admitted to the District Hospital of Tchintabaraden generally died during the first days of hospitalization from febrile ictero-hemorrhagic syndrome. Several hundred animals have died in the same areas since the beginning of the winter season. These were mostly calves and small ruminants that have died a few days after birth. There has also been an increase in the frequency of abortions and in utero deaths in animals. The local population linked these animal deaths to a probable zoonosis that would also affect humans after "consumption of animal products." Thus, on September 16, 2016, the Ministry of Health and the Ministry of Animal Resources carried out blood samples from animals and humans for confirmation by the Louis Pasteur Institut in Dakar, Senegal. These tests were positive for the Rift Valley Fever virus. Rift Valley Fever is the first of its kind in Niger. Several studies have been conducted on this epidemic but have not yet examined the factors associated with the disease [15,16]. The occurrence of serious complications such as neurological, hemorrhagic and hepatic disorders that sometimes lead to death make the research for risk factors of RVF in humans, a public health priority. A case-control study was conducted to identify factors associated with the disease and to implement effective control measures for its prevention.

Material and methods

Type of study and population

We conducted an unpaired case-control study in the health district of Tchintabaraden in the Tahoua region. Our target population was the entire population of the health districts of Tchintabaraden in Niger.

Inclusion criteria

A case was anyone living in Tchintabaraden with a fever (temperature ≥ 38.5 °C), muscle pain, skin, nasal, gastrointestinal or vaginal bleeding between August 2 and October 31, 2016. A control was a person living in Tchintabaraden without any symptoms of RVF at the time of the study.

Data collection tools and techniques

We used a data extraction sheet to process hospital records and individual medical records of cases, and used a pretested questionnaire for case and control interview. We collected information on age, sex, marital status, occupation, level of education, health facility of origin, village of residence, consumption of raw milk from sick animals, consumption of cheese from sick animals, handling of sick animals, consumption of meat from sick animals, contact with sick animals, contact with animals' carcasses, contact with abortion products, proximity of residence to ponds, rivers, dead animals not buried and the use of mosquito nets.

Data analysis

Data was analyzed using Epi-info software, version 7.1.2. Frequencies, proportions, rates were calculated. In univariate analysis, Rift Valley fever association ORs were estimated for all independent variables. Then, variables whose p-value were ≤ 0.20 were included in a multivariate logistic regression model,

and ORs with their 95% confidence intervals were calculated to identify factors independently associated with RVF. For the interpretation of significance, the threshold $\alpha \leq 0.05$ was used.

Ethical considerations

Our study protocol obtained the approval from the WAFETP program coordination and the Ministry of Public Health of Niger. Participation in this study was voluntary and only participants who gave informed and voluntary consent were included. Interviews were conducted with respect to confidentiality. Parental consent was sought when interviewing children under 15. Patients found in the community were referred to the treatment center.

Results

From September 25 to October 05, 2016, we interviewed 252 participants including 84 cases and 168 controls in the health districts of Tchintabaraden and Tassara. The median age was 17 years for cases and 35 years for controls. Table 1 shows that the majority of cases (54.7%) are female while the majority of controls (52.4%) are male. The illiteracy rate was 69% among cases and 70.8% among controls. The majority of cases were breeders. More than 80% of the participants were from the Tchintabaraden health district.

Table 1: Socio-demographic characteristics of Rift Valley Fever cases and controls, Tchintabaraden and Tassara, Niger 2016.

Characteristics		Cases (%)	Controls (%)
Age	1-4 years old	3 (3.57)	0 (0)
	5-14 years old	33 (39.28)	8 (4.76)
	15-24 years old	19 (22.62)	31 (18.45)
	≥ 25 years old	29 (34.52)	129 (76.78)
Sex	Female	46 (54.76)	80 (47.62)
	Male	38 (45.24)	88 (52.38)
Education	Illiterate	58 (69.05)	119 (70.83)
	Koranic School	7 (8.33)	34 (20.24)
	Primary School	16 (19.05)	7 (4.17)
	Secondary School	3 (3.57)	7 (4.17)
	High School	0 (0)	1 (0.60)
Profession	Breeder	30 (35.71)	85 (50.59)
	Housewife	22 (26.19)	67 (39.88)
	Student	17 (20.23)	4 (2.38)
	Child	14 (16.66)	2 (1.19)
	Health worker	1 (1.19)	3 (1.78)
	Other profession	0 (0)	7 (4.16)
Health District	Tchintabaraden	68 (80.95)	136 (80.95)
	Tassara	16 (19.05)	32 (19.05)

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In a univariate analysis (Table 2 and table 3), factors associated with RVF were age with OR of 6.27 [3.53-11.4], $p \leq 0.001$, being housewives (0.53 [0.30-0.95], $p = 0.045$), breeders (0.54 [0.31-0.93], $p = 0.035$), raw milk consumption of sick animals (2.74 [1.48-5.07], $p = 0.002$), consumption of raw milk cheese

of sick animals (2.81 [1.41-5.37], $p=0.002$), consumption of sick animal meat (2.85 [1.23-6.60], $p=0.020$), contact with a sick animal (2.32 [1.35-3.97], $p=0.002$), contact with a dead animal (3.10 [1.35-7.10], $p=0.010$), contact with animal abortion secretion (2.17 [1.19-3.98], $p=0.016$) and proximity of non-buried dead animals to households (2.64 [1.47-4.75], $p=0.001$). In

multivariate analysis, (Table 4) consumption of milk from sick animals (OR=3.77 [1.63-8.73], $p\leq 0.001$), consumption of meat from sick animals (OR=2.92 [1.04-8.73], $p=0.04$) and contact with animal diseases (OR=2.71 [1.24-5.89], $p=0.01$) were factors independently associated with Rift Valley fever in Tchintabaraden.

Table 2: Socio-demographic characteristics associated with Rift Valley fever cases, Niger 2016, univariate analysis.

Characteristics		Cases	Controls	OR (95% Confidence Interval)	P-value
Age group	25 and over	29	129	1	
	1-24 years	55	39	6.27 (3.53-11.4)	0
Sex	Female	46	80	1	
	Male	38	88	0.75 (0.44-1.27)	0.34
Profession Breeder	No	54	83	1	
	Yes	30	85	0.54 (0.31-0.93)	0.035
Profession Housewives	No	62	101	1	
	Yes	22	67	0.53 (0.30-0.95)	0.045
Illiterate	No	26	49	1	
	Yes	58	119	0.91 (0.51-1.62)	0.88

Table 3: Attitudes associated with Rift Valley fever cases, Niger 2016: A univariate analysis.

Risk factors		Cases	Controls	OR (95% Confidence Interval)	p-value
Consumption of raw milk from sick animals	No	17	69	1	
	Yes	67	99	2.74 (1.48-5.07)	0.001
Consumption of raw milk cheese from sick animals	No	59	146	1	
	Yes	25	22	2.81 (1.41-5.37)	0.002
Consumption of meat from sick animals	No	70	157	1	
	Yes	14	11	2.85 (1.23-6.60)	0.02
Contact with a sick animal	No	40	114	1	
	Yes	44	54	2.32 (1.35-3.97)	0.002
Contact with a dead animal	No	69	157	1	
	Yes	15	11	3.10 (1.35-7.10)	0.01
Contact with secretion of animal abortion	No	57	138	1	
	Yes	27	30	2.17 (1.19-3.98)	0.016
Proximity to dead animals not buried with households	No	20	76	1	
	Yes	64	92	2.64 (1.47-4.75)	0.001
Sick animal slaughter	No	81	157	1	
	Yes	3	11	0.52 (0.14-1.94)	0.496
Sick animal skinning	No	80	156	1	
	Yes	4	12	0.65 (0.20-2.08)	0.64
Use of impregnated mosquito net	No	13	49	1	
	Yes	54	119	0.74 (0.42-1.29)	0.29
Residence near a pond/river	No	14	28	1	
	Yes	70	140	1 (0.49-2.01)	1
Caring for a patient with RVF	No	69	102	1	
	Yes	15	66	0.33 (0.17-0.63)	0

Table 4: Multivariate analysis of risk factors for Rift Valley Fever, Niger 2016.

Risk factors	Odds Ratio	95% CI	P-Value
Cheese consumption made from milk of sick animals	3.77	1.63-8.73	0
Consumption of meat from sick animals	2.92	1.04-8.17	0.04
Contact with sick animals	2.71	1.24-5.89	0.01
Contact with dead animals	2.12	0.71-6.29	0.17
Consumption of raw milk from sick animals	1.95	0.91-4.14	0.08
Existence of dead animals not buried near households	2.09	0.98-4.44	0.05
Caring a patient with FVR	0.47	0.21-1.05	0.06
Contact with secretion of abortion	1.14	0.50-2.57	0.74

Discussion

In our study, milk cheese consumption was associated with RVF. Cheese, a dairy product, is one of the main income generating activities of women in the area. Thus, they traditionally make cheese using raw milk acquired from milking animals. Consumed or handled products from sick animals and drinking raw milk was also found associated to RVF [6,8]. In 2016, Tattevin in Congo found that the Rift Valley Fever virus was isolated in raw milk and that consuming it presented a risk factor [17].

Consumption of sick animal products was statistically associated with Rift Valley Fever. Indeed, in the department of Tchintabaraden, the majority of the population lives with domestic animals. As a result, when an animal is sick or dying, it is slaughtered for family consumption without any research to find the cause of the disease.

Contact with sick animals was also significantly associated with the occurrence of the disease. This could be explained by the fact that direct contact with the blood or biological products of sick animals increases the risk of transmission of the disease. In this locality of Niger, an animal that gives birth is automatically assisted by the inhabitants of the concession. Our results corroborate those reported in previous studies [6,8,17]. The majority of human contamination reported during epidemics in Africa are due to the handling of sick animal products [17-19].

Inter-species transmission of Rift Valley fever occurs primarily through direct contact with contaminated animal products. The fact that the population of our study was predominantly illiterate limited access to information about the mode of transmission of the disease. In Kenya, the participants of the study of Ng'ang'a believed that infections in humans occurred as a result of mosquito bites and had little to do with their consumption of meat, milk and blood from infected livestock. The participants in this study indicated that they had heard of the risks of acquiring the disease through consumption of livestock products but their experience did not tally with the information they had received, hence, to them, Rift Valley fever was not communicable through their dietary practices [20].

Conclusion

Our study shows that the factors associated with Rift Valley fever are consumption of raw milk cheese from a sick animal, contact with a sick animal and consumption of meat from a sick animal. Proper control of the risk factors for the disease will help limit its spread and reduce human mortality rate. We therefore recommend that people be made aware of the risks associated with consumption and handling of products from sick animals.

Disclosures

The authors state that there is no conflict of interest.

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