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Factors Associated with Chikungunya Fever Outbreak in Ethiopia, June 2016

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Abstract

Introduction: Chikungunya is a vector borne virus in alphaviridae family passed to humans by Aedes mosquito bite. Chikungunya virus has been transmitted by Aedesaegypti and Aedes Albopictus mosquitoes. Laboratory confirmation can be done via detection of CHIKV and anti-CHIKV antibody in blood samples. Because it is a risk group three pathogen, its containment is in biosafety level 3 facilities.

Objective: To determine factors associated with Chikungunya fever outbreak in Dolo ado district, Liben zone, Somali regional state, South-Eastern Ethiopia from June 10 to 17, 2016.

Methods: An unmatched case-control study design was used to investigate the outbreak from June 10 to 17, 2016. Epidemiological data were collected through face to face interview using structured questionnaire. Laboratory tests were performed all 17 serum samples using Real Time Reverse Transcriptase Polymerase Chain Reaction (rRT-PCR) technique. Results were displayed using texts, tables and graphs and statistical significance was interpreted using Odds ratio with 95% confidence interval and P value <0.05 after logistic regression was performed.

Result: In a multivariable analysis, failure to use long lasting impregnated net [AOR=14.6,(1.7-127.8), (p=0.015)], presence of Aedes mosquito larvae in water holding container during the investigation time [AOR=25.6(1.5-442.5), (p=0.025]) and travel history to Mandera (the neighboring Kenyan town) 2 weeks back from the date of onset of illness [AOR=37.3(4.3 - 321.3), (p=0.001)] were found associated with the disease. The odds of respondents who did not use bed nets while sleeping during daytime were 14.6 times more to have the disease than those who used bed nets. Basically, this finding is applicable for Aedesaegypti because it bites in the day time, and to the contrary using bed nets in a very hot weather may not be comfortable.

Conclusion: This investigation notes that Chikungunya has emerged in Ethiopia as additional cause of acute febrile illness. Vector control intervention, particularly, long lasting insecticide nets, indoor residual spray and larvicidal should be applied to halt the transmission. Continuous education should be offered for border crossing people to dress long sleeved clothes. Ministry of health of Ethiopia should recognize the disease as public health threat and prepare guideline, intervention strategy and reporting mechanism.

Keywords: Chikungunya; Virus; Outbreak; Ethiopia

Introduction

Chikungunya is a vector borne virus in alphaviridae family passed to humans by Aedes mosquito bite [1]. It was isolated in Tanzania in 1953 [2,3]. Chikungunya is believed to have originated from Africa and spread to islands off the eastern coast of Africa [4]. The attack rates for Chikungunya outbreaks have been evidenced to range from 35% to 75%. In 2006, after an apparent gap of about 32 years during which CHIKV was not detected, CHIKV disease has attacked many people in India in numerous states, suspected number of cases ultimately reaching more than 1.3 million [2,4]. Three genotypes of CHIKV, called West African, East/Central/South African (ECSA), and Asian have been defined, of which the latter two caused large outbreaks. ECSA genotype virus, was responsible for the epidemics on islands in the Indian Ocean. Thus, it was quite unexpected when the ongoing outbreaks in the Caribbean region were found to be due to an Asian genotype virus. Chikungunya virus has been transmitted by Aedes aegypti and Aedes albopictus mosquitoes. There is evidence that ECSA strains have been adapted to Ae. Albopictus whereas Ae. aegypti have greater competence for Asian strains over ECSA strains [5-8]. Chikungunya virus, as it is a risk group 3 pathogen, is containment in biosafety Level 3 facilities, equipment, and operational practices for work involving infectious or potentially infectious material [9,10]. Currently, the Ethiopian public health institute arbovirus testing set up is equipped with a real time RT-PCR principle. This set up is now based at the Ethiopian national influenza laboratory which previously detected new pathogens, like Dengue and Yellow Fever Viruses. This laboratory has a capacity to detect other pathogens, such as Zika, west Nile, Crimean Congo, Rift Valley fever viruses. The Ethiopian public health institute received 10 serum specimens on June 6, 2016 and immediately deployed investigation team. This investigation was done to confirm the emergence and explain possible factors associated with Chikungunya outbreak in Ethiopia.

Materials and Methods

Dolo ado district is one of the districts of Liben Zone, Somali Regional Sate, which is located in South-Eastern Ethiopia. It is located 1,050 kms far from the capital Addis Ababa. The district has a total population of 133,368, out of which 51% of the population was females

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(Source: Dolo Ado Woreda health office). An unmatched case-control study design was used to investigate the outbreak from June 10 to 17, 2016. Cases were identified by the Chikungunya case definition adapted from WHO regional office for south-east Asia. A total of 33 cases and 66 controls were interviewed with a ratio of 1:2 making total participants 99. Acute onset of fever >38.5°C and severe arthralgia/arthritis not explained by other medical conditions was the selection criteria for cases.

Epidemiological data were collected through face to face interview using structured questionnaire prepared in English with the help of local guides and translators, and laboratory specimen was collected by the investigator. Serum samples were collected. Laboratory tests were performed for Dengue fever Virus and Chikungunya viruses for all 18 serum samples using Real Time Reverse Transcriptase Polymerase Chain Reaction (rRT-PCR) technique to identify the etiology of the existing febrile illness. The data were checked for completeness and consistency and analyzed using SPSS version 21 software. Logistic regression was applied to determine the factors associated with Chikungunya fever disease outbreak. Results were displayed using texts, tables and graphs and statistical significance was determined using Odds ratio with 95% confidence interval and P value <0.05. Support letter was written to those concerned so as the national investigation team, as a public health emergency response body, can responsibly and accountably undertake the response activity at the site of the outbreak.

Ethical Clearance

A letter was written for the regional health bureau in order to obtain approval on the data collection. An informed consent was obtained from all study participants. Where the age was less than 18 years, assent was obtained from the participants and permission was obtained from respective parents/guardians. Confidentiality of information was assured and ensured. Participants were treated with respect and willingly participated in the study with no payment.

Result

Descriptive Epidemiology

A total of 99 individuals (33 cases and 66 controls) were interviewed. From the total respondents, 37(37.4%) were males and 62(62.6%) were females. The median age of participants was 28 years (range from 3 to 70). From the total cases, 5(15.2%) were singles, 27(81.8%) were married and 1(3.0%), similarly 16(24.2%) of the controls were single, 45(68.2%) were married and 2(3.0%) were divorced/separated. Regarding occupation of the cases, 5(15.2%) were students, 8(24.2%) were daily laborers, 13(39.4%) were house wives, 2(6.1%) were merchants, 3(9.1%) were farmers and 2(6.1%) were government employees. Among the controls, 12(18.2%) were students, 5(7.6%) were daily laborers, 27(40.9%) were house wives, 8(12.1%) were merchants, 1(1.5%) were farmers and 13(19.7%) were government employees. More than half of the cases, 20(60.6%) could not read and write, 10(30.3%) have, completed primary education, 2(6.1%) have completed secondary school and a person out of 33 has completed college [11]. Whereas among the controls, 24(36.4%) could not read and write, 24(36.4%) have completed primary education, 13(19.7%) have completed secondary school and 5(7.6%) have completed college/university. The interviewees were also asked some knowledge questions regarding Chikungunya fever. Based on the interview, 14(42.4%) of the cases and 26(39.4%) of the controls have heard about Chikungunya from different sources.

Analytical Epidemiology

The availability and use of LLINs were assessed and 54.5% of the cases have LLINS while 87.9% of the controls had access to LLINs. Among those who have LLINs, 17.6% of the cases and 67.2% of the controls use it while sleeping. Almost all respondents had water holding containers in their houses, and larvae were identified from the water holding containers of 12(37.5%) cases and 1(1.5%) control. There was no stagnant water in that area and there is only one river, Dawa River, which is more than 200 meters from the village. Moreover, none of the respondents' house was sprayed in the last three months. In terms of close contact, 66.7% of the cases had close contact with a person of the same complaint, while only 36.4% of the controls had similar exposure. None of the respondents used mosquito repellant neither on their skins nor in their houses except a single case. Among the cases, 42.4% wear long sleeved clothes and 66.7% of the controls wear long sleeved clothes as shown in Table 1.

After a multivariable analysis, utilization of LLINs, presence of Aedes mosquito larvae in water holding container during the investigation time and Travel history to Mandera (the neighboring Kenyan town) with in the past 2 weeks from the date of onset of the disease were important risk factors as shown in Table 2.

Discussion

First of all, this study is a case control study and hence could not determine the prevalence of Chikungunya virus in Dolo Ado woreda. Because of unavailability and shortage of diagnostic reagents, and the difficulty of the area to transport specimens easily, only limited specimens were collected relative to the large number of cases. The detection of Chikungunya virus nucleic acid, RNA, in most of the specimens by rRT-PCR can be considered as the first virological evidence of the existence of Chikungunya virus in the country's public health history.

Characteristics	Cases n=33	Controls n=66	COR(95% CI)	P-Value
Availability of LLINs				
Yes	19(57.6%)	58(87.9%)		
No	14(42.4%)	8(12.1%)	5.3(1.9-15.1)	0.001
Utilization of LLINs				
Yes	3(9.1%)	39(59.1%)		
No	30(90.9%)	27(40.9%)	14.4(3.9-52.2)	0
Status of Water Holding Container				
Open	22(68.7%)	37(56.9%)		0.019
Closed	10(31.3%)	28(43.1%)	2.9(1.2-7.1)	
Presence of Larvae in Water-holding Container				
Yes	12(37.5%)	1(1.5%)	38.3(4.7-311.9)	0.001
No	20(62.5%)	64(98.5%)		
Close Contact with Ill Person in the Last 2 weeks				
Yes	22(66.7%)	24(36.4%)	3.5(1.4-8.4)	0.005
No	11(33.3%)	42(63.6%)		
Travel history to Mandera(Kenya) with in the past 2 weeks				
Yes	20(60.6%)	2(3.0%)	49.2(10.2-236.8)	0.000
No	13(39.4%)	64(97.0%)		
Type of cloths				
Long sleeved	14(42.4%)	44(66.7%)		
Short Sleeved	19(57.6%)	22(33.3%)	2.7(1.1-6.4)	0.023

Table 1: Factors associated with Chikungunya fever disease, Dolo Ado District, June 2017.

Characteristics	Case n=33	Control n=99	COR (95%CI)	AOR (95%CI)	P-Value for AOR
Utilization of LLINs while sleeping					
Yes	3(9.1%)	39(59.1%)	01:00	01:00	
No	30(90.9%)	27(40.9%)	14.4(3.9-52.2)	14.6(1.7-127.8)	0.015
Presence of Larvae in Water-holding Container					
Yes	12(37.5%)	1(1.5%)	38.3(4.7-311.9)	25.6(1.5-442.5)	0.025
No	20(62.5%)	64(98.5%)	01:00	01:00	
Travel history to Mandera (Kenya) with in the past 2 weeks					
Yes	20(60.6%)	2(3.0%)	49.2(10.2-236.8)	37.3(4.3 - 321.3)	0.001
No	13(39.4%)	64(97.0%)	01:00	01:00	

Table 2: Independent predictors of Chikungunya fever disease, Dolo Ado District, June 2017.

Although the genotyping was not done for this outbreak in Ethiopia, having no reported death due to Chikungunya is fortunate unlike could have been deaths attributed to Chikungunya outbreak in Americas by the Asian type.

On multivariable analysis, the study showed that utilization of LLINs, presence of larvae in the water holding container and previous travel to Mandera, the Kenyan town before two weeks from the interview remained associated with Chikungunya fever disease. The odds of respondents who did not use bed nets while sleeping in daytime were 14.6 times more to have the disease than those who used bed nets. Basically, this finding is applicable for Aedes mosquito bites in the day time, and meanwhile the respondents might have thought it shameful to respond negatively because it is not comfortable to use bed nets since the study area is very hot. Presence of larvae of Aedes mosquito in the water holding container of the respondents was found cause of Chikungunya fever infection though effect of type of container was not studied. This association of Chikungunya infection is consistent with the risk factors of Chikungunya infection in Nepal.

We have also found a significant association between Chikungunya fever disease and travel to the Kenyan town of Mandera. A case control study conducted in Malaysia showed similar risk factor for Chikungunya infection (OR=3.24, 95% CI: 1.82, 5.78, p<0.0001).

Conclusion and Recommendation

This investigation confirmed the emergence of Chikungunya virus in Ethiopia and there is no way that it cannot cause illness again and affect all ages and both sexes. This reveals that we have faced a new cause of acute febrile illness. Failure to use impregnated bed nets while sleeping in daytimes, mosquito breeding in household water holding containers and movement to Chikungunya affected area of Kenya (Mandera) were factors favored illness due to Chikungunya virus. Vector control intervention, particularly, LLINs, IRS and larvicidal should be applied to halt the transmission. Continuous education should be offered for border crossing people to dress long sleeved clothes. Ministry of health should recognize the disease as public health threat and prepare guideline, intervention strategy and reporting mechanism.

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The work presented here was carried out in collaboration between all authors. Desalegn Belay collected laboratory specimen, coordinated epidemiological data collection and analyzed the data, did laboratory work and wrote the manuscript. Diriba Sufa participated on field work and data collection manuscript writing. Shikur Mohamed reviewed the manuscript. Abyot Bekele supervised and coordinated logistic supply. Mesfin Mengesha and Adamu Tayachew carried out laboratory work. All Authors have participated in the interpretation of findings and review of the manuscript. All authors read and approved the final manuscript.

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