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Sero-Prevalence of Measles in Southern Darfur State, Sudan

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Abstract

Background: Measles is a highly contagious acute viral disease; it remains among the top causes of death in young children globally. The purpose is to study the serology and clinical profile of measles in Southern Darfur State, Sudan.

Methods: Cross-sectional laboratory-based study was conducted (2011-2015) in six health zones in Southern Darfur State, Sudan. A total of 511 sera were obtained from measles patients during the surveillance, and the sera were screened for IgM antibodies using ELISA.

Results: A 43.4% of cases was males, and 56.6% were females, the commonly affected age was 1-4 years in both sexes. The sero-prevalence of measles lab-confirmed cases was 48.5%, most cases were reported in Nyala and Rahad Elberdi health zones. The suspected measles cases were increased from February to June and decreased from July to December. Measles lab-confirmed cases were higher compared with Epi-linked and Measles compatible cases in different health zone. The characteristic of measles clinical symptoms was fever 100%, cough 100%, maculopapular rash 100%, running nose 22.1%, conjunctivitis 67.3%, arthritis 25.8%, and lymphadenopathy 6.7%. However, 25.0% of cases had severe measles complication, 98.2% were recovered during the hospitalization, and 1.8% resulted in death. A 21.3% of cases were vaccinated, and 48.53% had measles IgM positive antibody. The trend of measles shown clinically significant differences in gender (χ^2=55.68, P<0.001), age year (χ^2=48.83, P<0.001) and presences of measles IgM antibody in the serum (χ^2=261.27, P<0.001).

Conclusion: The study reported a high percentage of measles IgM antibody in Southern Darfur State.

Keywords: Measles IgM antibody; Sero-prevalence; South Darfur; Sudan

Introduction

Measles is an acute, highly infectious viral disease. The disease symptoms start with a cough, fever, and a maculopapular rash that can lead to severe complications, including acute diarrhea, encephalitis, ear infection, blindness, inflammation of the brain, and pneumonia, followed by substantial morbidity mainly in a developing country [1,2].

Despite the unique national childhood vaccination campaigns that have been successfully used to control measles morbidity and mortality over the past years, measles continues to be endemic in many developing countries. The ways for prevention and control of measles elimination are especially challenging to implement in East Africa, because of its limited infrastructure and political instability [3], in addition to the insufficient vaccination coverage, logistical problems related to cold chain maintenance, and civil wars. Therefore, measles remains a public health concern in developing areas [4,5].

In developing areas of Africa and Asia countries, measles affects about 20 million people a year [6,7], and 95% of measles death cases occur in developing countries with weak health infrastructures [2].

In the African region, where the measles vaccine was introduced in the 1970s, the mortality was declined to 40% [8]. Recent studies indicated that measles-related death was decreased by 90% between 2000 and 2008 through the effective implementation of WHO and UNICEF-recommended control strategies [9]. A second dose of measles-containing vaccine given during supplemental immunization activities played a vital role in raising the population's immunity levels. However, routine vaccination coverage remains low, and health systems are still weak [9,10]. The previous study showed that 86.8% of children were positive for the anti-measles virus-specific IgM antibodies [11].

Recently more than1600 suspected measles cases with 710 confirmed have been reported from 23 localities in 12 states of Sudan

[2]. The latest study conducted by Musa et al. indicated an increase in measles cases in South Darfur state [12]. Furthermore, The Darfur region is considered the most affected state in Sudan [2]. In this study, we reported the serological findings and clinical profile of measles in Southern Darfur State, Sudan.

Methods

Study area

The study was conducted in Southern Darfur State, Sudan, the state covered an area of 127,300 km^2 and occupied by approximately 4,069,300 people, most are displaced people IDPs from the northern and western Darfur States. The state has six health zones, including Nyala, Iddel Fursan, Tulus, Buram, Rahad Elberdi, and Kass. Nyala city is the capital of the State.

Study population

The data in this study was obtained from the WHO sub-office Nyala. In total, 511 notified cases were eligible for inclusion during the measles surveillances from 1st January 2011 to 31st December 2015, from six health zone in Southern Darfur State, Sudan. The cases were admitted to local primary health care centers in Southern Darfur state. The data obtained includes demographic, vaccination status and clinical symptoms of suspected measles. The study was approved by the Ministry of Health, Southern Darfur State, Sudan.

Measles IgM antibodies detection

Blood samples were collected from all patients during the study period; blood samples were allowed to clot and then centrifuged at 3000 rpm for 5 minutes. The sera were then harvested into clean, sterile bottles and stored at -20°C before assay. The serological test was carried out by ELISA based on the World Health Organization guideline protocol [6]. Where define measles case surveillance as;

Suspected A case with signs and symptoms consistent with measles clinical criteria.

Laboratory confirmed: A suspected case that meets the laboratory criteria for measles case confirmation.

Epidemiologically linked: A suspected case that has not been adequately tested by laboratory and was in contact with a laboratory-confirmed measles case 7-18 days before the onset of symptoms.

Clinically compatible: A suspected case that has not been adequately tested by laboratory and has not been epidemiologically linked to a confirmed measles case.

Discarded: A suspected case that was investigated and discarded, either through negative results of adequate laboratory testing for measles or by an epidemiologic link to a laboratory-confirmed case of another disease.

Statistical Analysis

The data from 2011 to 2015 were extracted and analyzed using SPSS (version 20.0; SPSS Inc., Chicago, IL). The frequency of cases was calculated using frequency analysis, cross-tabulation and chi-square tests. A P-value <0.05 was considered statistically significant.

Results

A total of 511 samples were clinically confirmed measles cases in six health zones; Nyala 297 (58.1%), Iddel Fursan 15 (2.9%), Tulus 10 (2.0%), Buram 20 (3.9%), Rahad Elberdi 152 (29.7%), and Kass 17 (3.3%).

Among studied cases, 222 (43.4%) were males, and 289 (56.6%) were females, their ages ranged from 1 to 15~ years. Cases aged less than five years old were most affected by measles compared with other aged groups (Figure 1).

The seasonality of suspected measles cases indicates that measles cases were increased during February, March, April, May, and June. Whereas, the measles cases were decreased in July, August, September, October, and December (Figure 2).

Measles lab-confirmed cases are high compared with Epi-linked and Measles compatible cases in different health zones (Figure 3). Measles positive and negative cases in different health zones are presented in figure 4.

Measles clinical symptoms were fever 511 (100%), cough 511 (100%), maculopapular rash 511 (100%), running nose 113 (22.1%), conjunctivitis 344 (67.3%), arthritis 132 (25.8%), and lymphadenopathy 34 (6.7%). However, 128 (25.0%) of measles cases displayed severe complications, and 502 (98.2%) were recovered during the hospitalization, while the mortality rate was 9 (1.8%) (Table1).

There were clinically significant differences in gender (χ^2=55.68, P<0.001), age year (χ^2=48.83, P<0.001) and presences of antibody in the serum for measles IgM antibody (χ^2=261.27, P<0.001) (Table 2).

Discussion

Measles remains among the top causes of death in young children globally [6]. Due to its high infectious rates and the potential severity of complications, measles often constitutes a severe public health event entailing a vigorous response from public health departments and can involve multiple states and counties [13]. In Sudan, the measles was reported in Gedarif and Kassala States in December 2014. Recently, new cases were reported among internal displacement people in Northern Darfur (Jabel Amer, Sharaf Omra) [14]. The present study indicated that measles remained a public health concern in Southern Darfur state. Among measles cases, the percentage of females was higher than males, and most cases were reported in aged less than five years. Several epidemiological studies have shown that infection with measles occurred within the first years of life [15,16]. Previous research indicated that 5% of deaths arose in children less than five years age despite the availability of a safe and effective vaccine [17].

In this study, we noticed an increase in measles cases in March and decreased in December every year. Dry (December-May) and rainy (June-November) seasons were found to influence the effect of measles

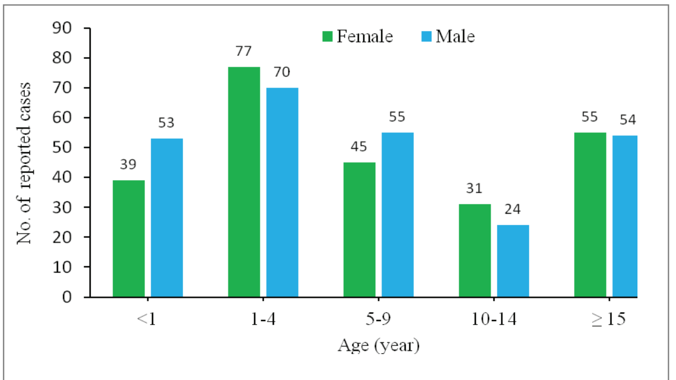

Figure 1: Gender and age differences in measles cases.

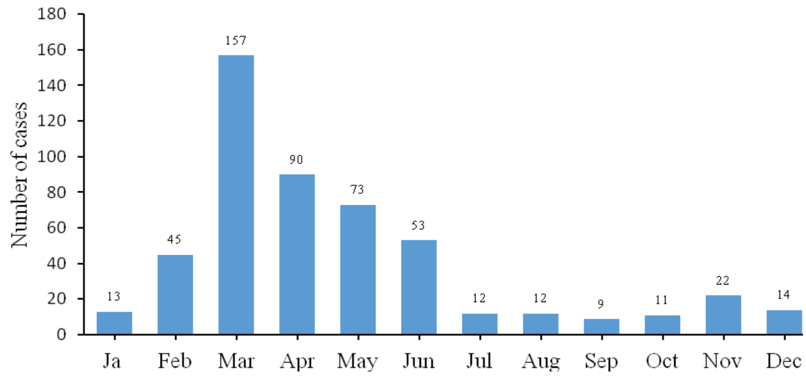

Figure 2: Seasonality of suspected measles cases in Southern Darfur State, Sudan.

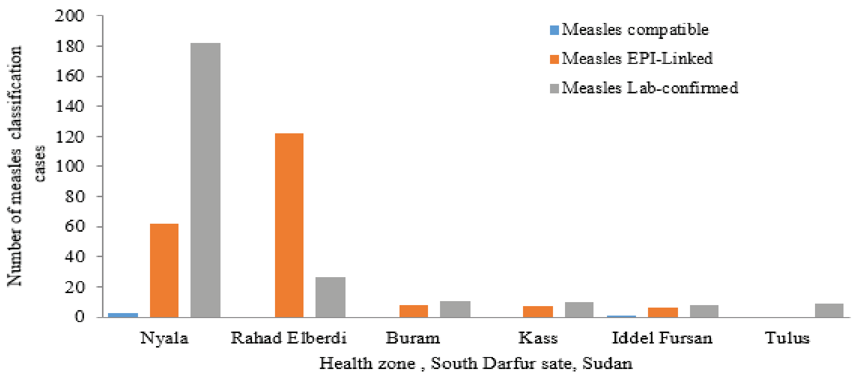

Figure 3: Measles lab-confirmed, Epi-linked and Lab-confirmed cases in different health zones.

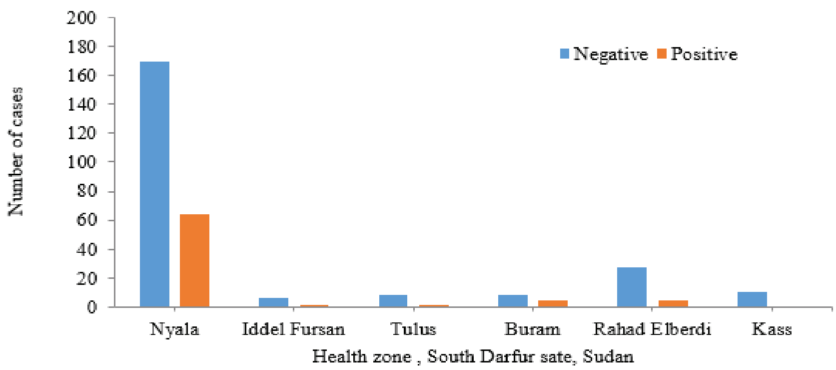

Figure 4: Measles positive and negative cases in different health zones.

virus on mortality [18]. Yang Q, et al. reported that both hot and cold temperatures decrease the incidence of measles, and low relative humidity is a risk factor for measles morbidity [19]. In temperate climates, measles typically occurs in the late winter and early spring every year, whereas, in the tropics, measles has irregular associations with rainy seasons [20].

The prevalence of positive measles IgM antibody was 43.4% in males and 56.6% in females. 48.5% of children have positive measles IgM antibody. However, Getahun M, et al. reported 31.3% positive measles-specific IgM in the Ethiopian population [21].

The most common clinical symptoms of measles were fever and skin rash followed by a cough, conjunctivitis and running nose. In

Table 1: Clinical presentation of the measles cases.

Characteristics	Categories	No.	(%)
Fever	Yes	511	(100)
A cough	Yes	511	(100)
Rash	Yes	511	(100)
Conjunctivitis	Yes	344	(67.3)
	No	55	(10.8)
	Unknown	112	(21.9)
Running nose	Yes	113	(22.1)
	No	322	(63)
	Unknown	76	(14.9)
Arthritis	Yes	132	(25.8)
	No	265	(51.9)
	Unknown	114	(22.3)
lymph node	Yes	34	(6.7)
	No	281	(55)
	Unknown	196	(38.4)
Complication	Yes sever	128	(25)
	Uncomplicated	259	(50.7)
	Unknown	124	(38.4)
Measles IgM antibody	Negative	54	(10.6)
	Positive	248	(48.5)
	Unknown	209	(40.9)
Travel history within the past 21days	Yes	511	(100)
Vaccination status	Vaccinated	109	(21.3)
	Unvaccinated	402	(78.7)
Vitamin A covered	Yes	161	(31.5)
	No	215	(42.1)
	Unknown	135	(26.4)
Measles outcome	Recovered	502	(98.2)
	Died	9	(1.8)

Table 2: Gender, age and Measles IgM antibody within the different years.

Characteristics	N	2011	2012	2013	2014	2015	χ^2	P-value
Gender n (%)	511	147 (28.8)	110 (21.5)	116 (22.7)	51 (10.0)	87 (17.0)	55.68	<0.001
Male	222 (43.4)	27 (5.3)	64 (12.5)	59 (11.5)	30 (5.9)	42 (8.2)		
Female	289 (56.6)	120 (23.5)	46 (9.0)	57 (11.2)	21 (4.1)	45 (8.8)		
Ratio		0.23	1.39	1.04	1.43	0.93		
Age year n (%)								
<1	41 (8.0)	5 (1.0)	10 (2.0)	14 (2.7)	0 (0.0)	12 (2.3)	48.83	<0.001
4-Jan	203 (39.7)	60 (11.7)	35 (6.8)	50 (9.8)	26 (5.1)	32 (6.3)		
9-May	95 (18.6)	28 (5.5)	26 (5.1)	23 (4.5)	11 (2.2)	7 (1.4)		
14-Oct	57 (11.2)	11 (2.2)	12 (2.3)	19 (3.7)	7(1.4)	8 (1.6)		
≥15	115	43 (8.4)	27 (5.3)	10 (2.0)	7(1.4)	28 (5.5)		
Measles IgM antibody								
Negative	54 (10.6)	6 (1.2)	11 (2.2)	11 (2.2)	22 (4.3)	4 (0.8)	261.3	<0.001
Positive	248 (48.5)	33 (6.5)	27 (5.3)	82 (16.1)	27 (5.3)	79 (15.5)		
Unknown	208 (40.9)	108 (21.2)	72 (41.1)	22 (4.3)	2 (0.4)	5 (0.8)		

contrast, Ibrahim SA, et al. indicated that cough and conjunctivitis were the most common manifestation followed by a running nose in Khartoum state [22]. White SJ, et al. reported that the prodromal stage occurs 10 to 12 days after exposure and is characterized by two to three days of fever, anorexia, and malaise combined with the triad of cough, conjunctivitis, and coryza. Measles induced complications affect approximately 30% of infected individuals, especially young children aged < 5 and adults ages ≥ 20. The most commonly reported complications are diarrhea, 8%, otitis media 7%, and pneumonia 6% [23].

In the present study, 21.3% of the cases were vaccinated. The previous study indicated that the timely administration of vaccines could ensure adequate protection against measles for all ages in a population [24]. Serologic and epidemiologic studies suggest that 1-dose measles vaccine efficacy is approximately 85%-90% when given at nine months of age and that 2-dose effectiveness is >99% when the second dose is given at ≥12 months of age. A two-dose measles vaccination schedule might reduce not only child mortality but also improve growth [10]. This may confirm the previous studies on vaccination coverage in other parts of the world which shown socioeconomic status, insecurity, cultural diversity, community attitude towards measles and religion plays an important reason for lack of vaccine covered [25,26]. Furthermore, many governmental efforts were committed to the Global Measles and Rubella Elimination Strategic Plan 2012-2020. The strategies include high vaccination coverage; monitoring of disease; outbreak preparedness and response and case management; communication and community engagement; and research and development in order, to control measles among the Sudanese population [2].

The limitations of the study are that some measles cases might not be reported during the study period. Furthermore, the study was based on clinically diagnosed with measles cases and immunization history for children, but not includes other socio-demographic data. Finally, the study concludes that the increase in measles cases in Southern Darfur State from 2011 to 2015 is likely a consequence of inadequate vaccination coverage.

Conclusion

The increase in the prevalence of measles cases in Southern Darfur state is likely a consequence of the inadequate prevention and control strategies presenting in vaccination coverage and reducing the mortality rate. Therefore, performing a continues vaccination campaign towards measles control and prevention among the population will be helpful to drop measles cases and mortality among children in South Darfur.

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Conflict of Interest

Authors have declared that no competing interests exist.

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