

The Risk of Lymphatic Filariasis Transmission in Belitung Regency After Elimination Program

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Abstract - Belitung Regency has passed Transmission Assessment Survey (TAS) in 2012, 2014, and 2016 respectively, which means that the Mass Drug Administration (MDA) in Belitung is being considered successful. This research has been conducted in February-November 2017, which aimed to analyze the program of filariasis elimination in Belitung Regency based on a cross-sectional approach. The design was cross-sectional study, located in Cerucuk Village (Badau Sub-district) and Kembiri Village (Membalong Sub-district) that consist of finger-prick blood survey, DNA detection of *Brugia malayi*, survey of Knowledge, Attitude and Practice (KAP), mosquito sampling, reservoir blood survey and environmental survey. The results showed that there was still transmission of filariasis in Belitung Regency. The main finding is partly due to the number of people who do not take the filariasis preventive medicine during MDA program, the existence of reservoir and vector of infection which is very supportive for new transmission. A regular blood survey that combined with health promotion are required for the prevention of filariasis. The Gotong Royong activity to eliminate mosquito breeding sites needs to be done periodically. The use of mosquito net at night is a preventive from being bitten by mosquitoes at home. The community needs efforts to protect themselves from mosquito bites during their activities in the farm.

Keywords: Transmission risk, filariasis, Belitung.

I. INTRODUCTION

Lymphatic filariasis is one of the endemic diseases in Indonesia [1]. This disease is caused by an infection of

filarial worm transmitted by mosquitoes, scattered almost in all major islands in Indonesia especially in rural areas and transmigrant settlements. Since the start of the mapping activities of filariasis sufferers through rapid surveys in Indonesia (1999), it has been reported that cases of filariasis have increased from 1,721 acute and chronic clinical cases in 1999 to 6,154 cases in 2000, spread across 26 provinces in Indonesia [2], after that, until the year 2004 in Indonesia estimated six million people were infected with filariasis, and reported more than 8,243 among them are chronic filariasis sufferers especially in rural areas [3].

The Minister of Health has launched the month of lymphatic filariasis elimination termed as BELKAGA in 2015, which was preceded by issuing Permenkes No. 94 year 2014 on the response of filariasis, as a revision of Kepmenkes No. 1582/2005 and Kepmenkes No. 893/2007. For district/municipality that failed the Transmission Assessment Survey (TAS) raises the problem of having to repeat the Mass Drug Administration (MDA) [4].

Filariasis is a fairly complicated disease handling, involving many parties and cooperation and good communication to be able to achieve the success of both national and global programs in 2020. This success is determined by the commitment of all related parties and sufficient participation of the community to address this problem. The advancement of filariasis elimination program is still around 72.1% endemic filariasis regency that have ceased to conduct MDA

and await the results of the evaluation and get an elimination predicate, but so other endemic regency are expected to follow soon and in 2020 all regency in Indonesia have finished implementing MDA [5].

Belitung Regency has conducted mass treatment of filariasis for 5 rounds. Results of evaluation survey in the 5th year (year 2010), not found microfilaria. Belitung Regency has carried out the TAS program three times (Years 2012, 2014, and 2016), the result have passed TAS (mass treatment of preventive filariasis considered successful) [6], in October 2017 got a certificate of elimination filariasis from the Minister of Health. This research aimed to analyze the program of elimination filariasis in Belitung Regency, which has been implementing MDA.

II. METHODS

This study has been conducted in February-November 2017, through the study approach of cross sectional. This research has obtained the ethics approval of the Ethics Commission for Health Research No. 02.01/2/KE/167/2017 dated 7 May 2017. The data collection location is Cerucuk Village (Badau Sub-district) and Kembiri Village (Membalong Sub-district) Belitung Regency which is chronic sufferers. Research design used cross-sectional study. Activities in the study include finger-prick blood survey, data collection knowledge, attitude, practice (KAP) community on filariasis, survey of potential mosquitoes as filariasis vector, blood sampling of reservoir animals, and environmental surveys.

Finger-prick blood activities are conducted to determine the presence of microfilaria in the blood. The timing of blood sampling begins around 08.00 p.m. Total sample for two villages are 620 people, with criteria aged over 5 years.

The filariasis KAP survey aimed to know the aspects of knowledge, attitudes and behavior of the community associated with elimination program of filariasis. Conducted interviews with structured questionnaires developed by the World Health Organization (WHO).

Mosquito survey was conducted with modification of human landing collection in mosquito nets to saw mosquito species containing the larvae L1, L2 and L3. The implementation was twice, with an interval of one month, at three points in Cerucuk Village and Kembiri Village. It begins in the afternoon at 17.00 p.m. until 06.00 a.m.

Activity of reservoir blood survey include collection of blood cats, dogs, long tail monkeys, done in purposive, the goal was to determine the presence of microfilaria

in the blood reservoir. The minimum number of samples in Belitung Regency for all species is 100 samples.

Environmental surveys were the collection of data and information related to the vector and reservoir biology environments in the research location. The number of samples for the biological vector environment were 70-100 house buildings at the finger-prick blood survey implementation site.

III. RESULTS

A. Description of Filariasis Control in Belitung Regency

In 2004, Belitung Regency was one of endemic filariasis area with the value of microfilaria rate (Mf rate) of 2,8% (national target of Mf rate < 1%), the figure is obtained when there are 67 positive cases in the finger-prick blood survey. Some of the areas conducted by 2004 finger-prick blood survey, among others, Membalong Sub-district (Membalong village and Kembiri Village), Selat Nasik Sub-district (Selat Nasik Village and SuakGual Village), Badau Sub-district (Cerucuk village), found *B. Malayi* in the five villages. In 2004, Kembiri Village and SuakGual Village were designated as sentinel villages. The next finger-prick blood survey was conducted in 2008, encompassing in the region of four villages (one village found microfilaria), the results showed a value of Mf rate of 0.1%, Kembiri village and SuakGual Village as sentinel village. The subsequent blood screening was conducted in 2010, encompassing four rural areas, the result was no village found positive microfilaria. The total number of clinical cases of filariasis in Belitung Regency until 2017 was 30 cases, which were entirely old cases.

The activity of MDA program in Belitung Regency started from 2006 until 2010. Evaluation survey was conducted in the third year after the mass treatment (2008), the result of one positive microfilarian village namely Kembiri Village (Mf rate 0.4%). Evaluation survey of the 5th year in 2010 did not find microfilaria.

Table 1. Coverage of POPM filariasis for five years of treatment In Belitung Regency

Years	Amount		Percentage
	Target (T)	Taking Medication (TM)	TM/T
2006	126.844	119.574	94,3%
2007	127.244	120.300	94,5%
2008	128.331	122.425	95,4%
2009	138.383	131.482	95,0%
2010	146.553	139.482	94,0%

B. Knowledge Research Subject on filariasis

In this study conducted interviews to the subject of research to be conducted clinical examination and taken blood finger. The number of samples in Cerucuk Village was 333 people, in Kembiri Village was 329 people. The results showed that most research subjects knew that the disease of filariasis was transmitted by mosquitoes; Cerucuk Village (20.2%), Kembiri Village (41.7%), but only a few subjects of the study who knew that filariasis was caused by worms; Cerucuk Village (2.7%), Kembiri Village (6.4%). Generally the research subject states that if exposed to filariasis then the legs or hands swell; Cerucuk Village (55.8%), Kembiri Village (62.8%).

Almost all research subjects state that no relatives or neighbors have repeated fever, accompanied by swelling of the thigh folding glands. However, there are 5% of research subjects in the Cerucuk Village which states that there are relatives/neighbors who have repeated fever, accompanied by swelling of the thigh folding glands, while in Kembiri Village (12.4%). Of the 5% and 12.4% of the subjects of the study, only 61% and 78.8% of research subjects were said to seek treatment to health care personnel. Only 59.7% of respondents in Cerucuk Village and 62.8% of research subjects in Kembiri Village know there are medical activities for all villagers in order to prevent the transmission of filariasis. Most research subjects obtain information from health workers.

C. Attitude Research Subject on Filariasis

The results of data analysis indicate there were subjects of this research still stated that filariasis can be prevented, even though they did not take filariasis drug; Cerucuk Village (14.7%), Kembiri village (19.2%). Generally the subject of research agrees if taking the drug filariasis, there must be prior notice; Cerucuk Village (80.6%), Kembiri Village (80.1%). Most research subjects agree that taking filariasis medications will cause side effects; Cerucuk Village (40.3%), Kembiri Village (50.9%).

There were subjects of this research still stated that to agree or believe that it will not be infected with filariasis, even if it does not drink a filariasis prevention drug; Cerucuk Village (26.0%), Kembiri Village (28.2%). There were still a study subject that assumes that the leg/hand is caused by drinking a filariasis prevention drug; Cerucuk Village (16.7%), Kembiri Village (22.9%). Generally, the research subjects stated to agree to take filariasis medication because of their own awareness; Cerucuk Village (88.8%), Kembiri Village (88.3%).

D. Behavioral Research Subject to Filariasis

The results showed that was only 47.7% of the research subjects in Cerucuk Village were to have participated in the treatment of mass disease prevention of filariasis, while in Kembiri Village it was 66.9%. From those who have been involved in preventive medicine, only 87.4% of the research subjects in Cerucuk Village were claiming to drink all medicines, while in Kembiri Village at 95.9%. Generally, drug filariasis in self-drinking at home unattended health officers; Cerucuk Village (92.0%), Kembiri Village 87.0%). There was a research subject stating that after taking the drug filariasis there was a worm that comes out of the mouth or while defecating; Cerucuk Village (3.3%), Kembiri Village (3.7%). Still there were research subjects who do not want to take medication filariasis because it feels healthy; Cerucuk Village (6.0%), Kembiri Village (6.2%). Generally research subjects used mosquito repellent to avoid mosquito bites inside the house; Cerucuk Village (47.7%), Kembiri Village (43.5%).

E. Endemicity Status of Research Area

In Table II appears that in Cerucuk Village found four positive of microfilaria with the type *B. Malayi* of 312 persons examined, while in Kembiri Village found four positive population of microfilaria with the type *B. Malayi* of 310 The person being examined. Table III the following shows the amount of microfilaria in every blood dosage taken on eight people.

Table 2. The results of a microscope examination to detect the presence of microfilaria from finger-prick blood survey in the community in Cerucuk village and Kembiri village

Villages	Result		Amount
	Mf Positive	Mf Negative	
Cerucuk Village	4	308	312
Kembiri Village	4	306	310
Total	8	614	622

Note: Mf= microfilaria

Table 3. Number of microfilari per blood dosage in the research subject positive microfilaria in Belitung Regency

Sex	Age	Address	Amount/ Type of Parasite
Male	34	Cerucuk	2 / <i>B. malayi</i>
Female	36	Cerucuk	4 / <i>B. malayi</i>
Male	14	Cerucuk	32 / <i>B. malayi</i>
Male	81	Cerucuk	13 / <i>B. malayi</i>
Female	58	Kembiri	30 / <i>B. malayi</i>
Female	53	Kembiri	30 / <i>B. malayi</i>
Male	60	Kembiri	43 / <i>B. malayi</i>
Female	60	Kembiri	22 / <i>B. malayi</i>

It can be seen from the variation in age and density of microfilariae in the blood, it is likely that when the

MDA program was implemented, the person did not take the preventative drug for filariasis, as in adolescents aged 14 years with the density of microfilaria high enough amounted to 32 microfilaria. While there are some new sufferers with a low density of microfilaria that are two tails, indicating that there is transmission of a new filariasis infection in the location.

The Health office of Belitung Regency assisted by the officers in Membalong and Badau Health Center, directly conduct selective treatment of eight new cases. The drug is administered for 10 days, after which the finger-prick blood survey is done again against the eight inhabitants, the results showed that the eight people had negative microfilaria in the blood. Table 5 the following shows the result of type of animal reservoir samples of microfilaria in Belitung Regency.

In Table IV shows that the cat was the dominant animal type taken blood samples in Cerucuk Village, while in Kembiri Village, the number of blood samples examined is almost the same between cats with long-tailed monkeys. The results of microscopic examination show that there are two dogs and three monkeys who are positive microfilaria of *Dirofilaria*. Once confirmed with a PCR examination, it turns into the blood of one of the monkeys, showing positive results for *B. Malayi*. The results of cat blood screening, all showed negative results of microfilaria, both in the village of Cerucuk and in Kembiri.

Table 4. The number of positive type of animal reservoir samples of microfilaria in Belitung Regency

	Type of animal reservoir	Amount Specimen	Result			
			Microscopic		PCR	
			Bm	Di	Bm	Di
Cerucuk Village	Cats	51	0	0	0	0
	Dogs	3	0	2	0	2
	Long-tailed monkeys	2	0	0	0	0
	Amount (a)	56	0	2	0	2
Kembiri Village	Cats	33	0	0	0	0
	Dogs	0	0	0	0	0
	Long-tailed monkeys	28	0	3	1	2
	Amount(b)	61	0	3	1	2
	Amount (a + b)	117	0	5	1	4

Note: Bm=*Brugiamalayi*; Di=*Dirofilaria*sp.; PCR= Polymerase Chain Reaction

Culexvishnui was the dominant type of mosquito caught in Kembiri Village. *Cx. vishnui* has never been confirmed as a vector filariasis of the *Brugia* type, but it can be a role as a transmitting filariasis of the *Wuchereria* type. However there were several types of mosquitoes caught in Kembiri Village, in other locations have been confirmed as vector filariasis of type *B. malayi*, among others *Mansoniauniformis*, *Ma.*

indiana, *Ma. annulifera* and *Ma. dives*. However, the age of the mosquito caught was still young (dilatation less than 4).

Cx. vishnui and *Armigeresdurhami* mosquitoes were the dominant types of mosquitoes caught in Cerucuk Village. *Cx. vishnui* and *Ar. durhami* had never been confirmed as a vector filariasis of both *Brugia* and *Wuchereria*. The results of the PCR test showed that there were two species of mosquitoes in Belitung district, which contains the filarial larvae are *Cx. vishnui* and *Aedesalbolineatus*.

F. Over view of Environmental Survey Results

The types of mosquito growth habitat found in Kembiri Village include swamp, springs, puddle ponds, riverbanks, paddy fields and irrigation. Some types of water plants that have the potential to support the development of *Mansonia* mosquito larvae found in Kembiri Village were among others *Pistiastratiotes* and *Ipomea aquatica*. This type of mosquito larvae breeding places in Cerucuk Village was a water spring that everyday people also used for bathing. Water springs in Cerucuk Village will overflow when the rain was quite high intensity.

IV. DISCUSSION

Results of blood screening that shows the results there are eight people who are positive microfilaria of the type *B. Malayi*, there is an indication that there is still transmission of filariasis in Belitung after elimination program. The existence of such transmission can be caused by several factors such as there are still disobedient people to take the drug preventive filariasis in the event of MDA, there is a reservoir animal that is the source of the snake to humans that has not been, as well as a mosquito breeding that serves as a vector of filariasis, which is supported by the presence of mosquitoes in the location of the site. Four people who do not take medication are possible because they do not understand the danger Filariasis and benefits of the distributed drug. Surtaningtiyas et al. study results in West Bangka shows that out of 66% of respondents have been taking

preventive filariasis, but only 2% of those who take preventive medicine five times, so that there is a positive sufferer filariasis with species *B. malayi* and the density of microfilaria of each sufferer at 116, 245 and 112 [7]. Likewise, the results of the study of Juariyahet al. in Tabalong Regency, South Kalimantan, showed that there is still a positive sufferer of filariasis

in Bilas Village as much as 11 people with the type of parasitic *B. malayi*. Community compliance to consume filariasis drugs in the village is relatively low that is 20% in patients with filariasis and 21.64% in non-sufferer filariasis. Identified only one person with filariasis who receive and consume filariasis medicines routinely. The low percentage of patients with positive filariasis and general public who consume filariasis drugs regularly may cause transmission [8].

In some theories mention that knowledge is the result of tofu, which happens after people do sensing a particular object. Sensing occurs through the five human senses, namely vision, hearing, smell, taste and tactile. Most of human knowledge is gained through the eyes and ears. Knowledge is one of the factors that affects behavior, because human behavior is actually a reflection of various psychiatric symptoms, such as knowledge, desires, wills, interests, motivation, perception, attitudes and so on [9].

Knowledge is an important factor that affects one's attitude and behavior. Lack of knowledge can affect the actions taken because knowledge is one of the predisposition factors for the occurrence of behavior [10]. Therefore to educate the public to have good behavior, citizens need to be given knowledge [6].

Health counseling on various diseases has been encouraged by the government to increase public awareness. Health counseling is one of the ways used to increase the knowledge and ability of a person through learning techniques or instruction with the intention of altering or influencing human behaviour individually, in groups or Communities to be more self-reliant in achieving healthy living [6].

Transmission of filariasis can occur because there are three elements, namely (1) the existence of a source of transmission, namely human or hospice reservoir containing microfilaria in his blood, (2) the presence of a vector, namely mosquitoes that can transmit filariasis and (3) human susceptible to filariasis [7].

Mosquitoes can act as a vector of transmission of filariasis depending on the mosquito's ability to prepare itself against the growth of filaria worm larvae to the infective stage (L3). If a vector mosquito is sucking the blood of the patient filariasis, then the microfilaria will be sucked through the proboscis, next to the mosquito stomach. A person may be infected with a filariasis, when a vector mosquito bite contains an infective larva or a 3rd stage larvae (L3). Not all the mosquitoes around us can transmit the disease. Mosquitoes that act as vector in each region will differ. A species of mosquitoes can be a vector when fulfilling some conditions such as the age of mosquitoes, the density of mosquitoes, there is contact between mosquitoes with

humans, susceptible to parasites and there is a source [8], [11]. Mosquitoes age must be long enough that the parasite can complete its life cycle in mosquito body. Contact between humans with mosquitoes that only occurred at a short time, this is utilized by some pathogen parasites for survival.

The genus of *Mansonia* (Diptera: Culicidae) consists of two subgenera, *Mansonia* and *Mansonioides*. The subgenus *Mansonioides* is included in the main vector in the transmission of lymphatic filariasis caused by *B. Malayi* in the South Asian and Southeast Asian regions. Six species in this subgenus are vectors of the lymphatic filariasis *B. malayi* periodic and Subperiodic, among others *Mansoniabonneae*, *Ma. dives*, *Ma. uniformis*, *Ma. annulifera*, *Ma. annulata* and *Ma. indiana*. The diversity of vector filariasis in Indonesia to the *Brugia* vector consists of six species of *Mansonia* namely *Ma. bonneae*, *Ma. dives*, *Ma. annulata*, *Ma. indiana*, *Ma. uniformis*, *Ma. annulifera* and *An. Barbirostris* [12].

Ma. uniformis is a type of mosquito that has been confirmed as a vector filariasis type *B. malayi* in Aceh, North Sumatera, Riau, West Sumatera, Jambi, Bengkulu, South Sumatera, Lampung, Central Java, West Kalimantan, central Kalimantan, Kalimantan East Timor, South Kalimantan, South Sulawesi, southeast Sulawesi, Maluku.

The results of the PCR test show that there are two types of mosquitoes that positively contain the Filarian larvae *Cx. vishnui* and *Ae. albolineatus*. Although it has never been confirmed as a vector of transmitting filariasis of the type *B. malayi*, but the age of mosquitoes, the density of mosquitoes and the contact of the mosquito with humans, it is possible that both types of mosquitoes act as a vector of transmitting. Mosquitoes can be vector filariasis if they have a long lifespan so that the parasite can complete their life cycle in the mosquito body. If the age of mosquitoes is longer than the age of parasites then automatic parasites can develop until it becomes an infective larva to transmit it. According to WHO, a worm develops from microfilaria to L3 on mosquito body for 10-13 days, then to be vector filariasis, mosquitoes must be aged more than 13 days. The longer the life of mosquitoes, the more likely it is to be a transmitting or vector [13]. Bionomik *Ae. albolineatus* are usually found on bamboo sections, scattered in southeast Asia (Malay Peninsula, Indonesia, including Sumatra, Java, Kalimantan, Sulawesi, Bali, Nusa Tenggara and Maluku) and India [14], [15]. *Cx. vishnui* has been confirmed as a vector of the Japanese encephalitis disease in Indonesia [16]. *Cx. vishnui* mosquitoes want to suck human blood, both inside and outside the

house, type of habitat where the dominant breeding is Paddy fields and used ponds [17].

The result of positive filarial larvae examination in mosquitoes, supported by the results of microscopic examination of blood reservoir found infected by the filarial of the genus *Dirofilaria* is 3 long-tailed monkeys (*Macacafascicularis*) and 2 dogs (*Canisfamiliaris*) [18]. Long-tailed monkeys have been confirmed as one of the reservoir animals in the transmission of filariasis type *B. malayi* [19], [20]. In this research the identification of parasites of the genus *Dirofilaria* only up to Genus levels not yet until the species. The test results with the PCR method found 4 samples with non *B. malayi* species and 1 sample with the *B. malayi* species. The results, indicating that in Belitung regency is still allowing transmission of filariasis, supported by the risk of the community's daily activities as farmers are generally close to reservoir animal habitats.

V. CONCLUSION

Belitung Regency has conducted the MDA program for five rounds and has passed TAS in 2012, 2014, and 2016 respectively, which means that the MDA program is being considered successful. Belitung Regency received a filariasis elimination certificate in 2017. However, the results showed that filariasis transmission still occurred in Belitung Regency. Several contributing factors, such as there were people who were not obedient to taking the preventive medicine for filariasis during the MDA program. In addition, the discovery of reservoir animals also supports the occurrence of transmitting transmission due to the reservoir habitat that was very close to the population settlements, supported by the behavior of filarial positive mosquito that many seek blood in the population.

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