

## Nairobi fly dermatitis cases in Ade charake village in Bodit town Administration, Wolaita Zone, SNNPR, Ethiopia, 2018

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### Abstract

**Background:** Nairobi fly dermatitis is unusual form of contact dermatitis caused by pederine, ahemolymph fluid released when the insects are crushed against the skin. Patients often present with a sudden onset burning sensation and cutaneous pain. The insects are belonging to the genus *Paederus*. These insects are found worldwide, although the concentration is higher in tropical and subtropical areas. In Ethiopia, more particularly in Wolaita, Nairobi fly dermatitis is uncommon previously. Hence, we aimed to describe the clinical characteristics and identify risk factors prone to the disease.

**Methods:** We conducted unmatched case-control study (ratio 1:2) with 45 cases and 90 controls from April 5 to 14, 2018 in Ade charake Village, Southern Ethiopia. Cases were patients who had a history of linear dermatitis, kissing/mirror image/lesions, multiple vesiculo-pustular lesion, extensive pustules, blistering and papulo-pustular lesions over face, neck, arms, shoulders, axillaries region, lower limbs, chest, upper limbs or any other area of the body in Ade Charake Village in the study period. Controls were asymptomatic individuals selected randomly from the households or neighbors during the outbreak period. The investigators initially developed a clinical-epidemiological questionnaire to obtain data from cases as well as controls. Basic descriptive summary including attack rate, in addition to bivariate and multivariable logistic regression was computed. The odds ratio was computed at 95% CI with a P-value  $\leq 0.05$  to ascertain the association.

**Results:** Among 45 cases, 60 % (27/45) were females. The commonly affected age groups were between 8-15 years 31% (14/45). The frequently appearing clinical manifestation was Erythmato-vesicular lesions 40% (18/45) and most patients 71% (32/45) presented with a complain of burning sensation followed by pruritus 62% (28/45). We found that use of light during sleep (AOR=8.5, 95% CI, 1.033-64.8), disposing wastes near vicinity (AOR=5.44, 95% CI 2.094, 14.1250) and proximity of dense vegetations or fruit in the vicinity (AOR=7, 95% CI, 1.143-43.78) were risk factors to develop Nairobi fly dermatitis.

**Conclusion:** We found that Nairobi fly dermatitis predominantly affects females while sleeping with light on and disposing of wastes near vicinity. The presence vegetation's and/or fruits in the neighborhood found to be the risk factors for Nairobi fly dermatitis.

**Keywords:** Nairobi fly, Outbreak, Ethiopia.

### Introduction

Nairobi fly (*Paederus*) dermatitis is a peculiar, irritant contact dermatitis characterized by a sudden onset of erythematobul-lous lesions on exposed areas of the body. Common species of *Paederus* which have been reported to cause contact dermatitis were *P. sabaeus*, *P. fuscipes*, and *P. eximius* [1]. There are 600 species of genus *Paederus* worldwide. It is an active predator of several crop-damaging insects and occurs in warm tropical cli-

mates [2]. In East Africa, outbreaks of *Paederus* dermatitis and conjunctivitis were mostly reported in Kenya and northern Tanzania after the 1997/1998 El Niño rains [3]. A rapid increase in their population has been attributed to the increased rains associated with the el Niño phenomenon [4]. The name 'Nairobi fly' is applied to *Paederussabaeus* Erichson and *Paederus crebrepunctatus* that both cause dermatitis and conjunctivitis in East Africa. *Paederus* dermatitis has also been reported from Nigeria, France,

Okinawa, Australia, Malaysia, Indonesia, Thailand, Singapore, Taiwan, India, Vietnam (Perumbavoor, Kerala), Sierra Leone and Sri Lanka [5-6]. These insects require moist soils for their normal life cycle, so their population increased rapidly during March-April and July-August due to favorable abiotic environmental factors [7]. The difference in population during different months was due to biotic factors including different crops and such abiotic factors as temperature, relative humidity and soil moisture contents [8]. It is synthesized in only about 90% of the females the manufacture of pederin is largely confined to adult female beetles—larvae and males only store pederin acquired maternally (i.e., through eggs) or by ingestion [9]. Recently, it has been demonstrated that the production of pederin relies on the activities of an endosymbiont (*Pseudomonas* bacteria species) within the beetle that probably essential for the synthesis of pederin and present only in the (+) females [1]. They can be especially troublesome if windows or doors are left wide open. This beetle does not bite or sting, but accidental brushing against it or crushing it over the skin provokes the release of its coelomic fluid, which contains pederin, a potent vesicant agent that re-

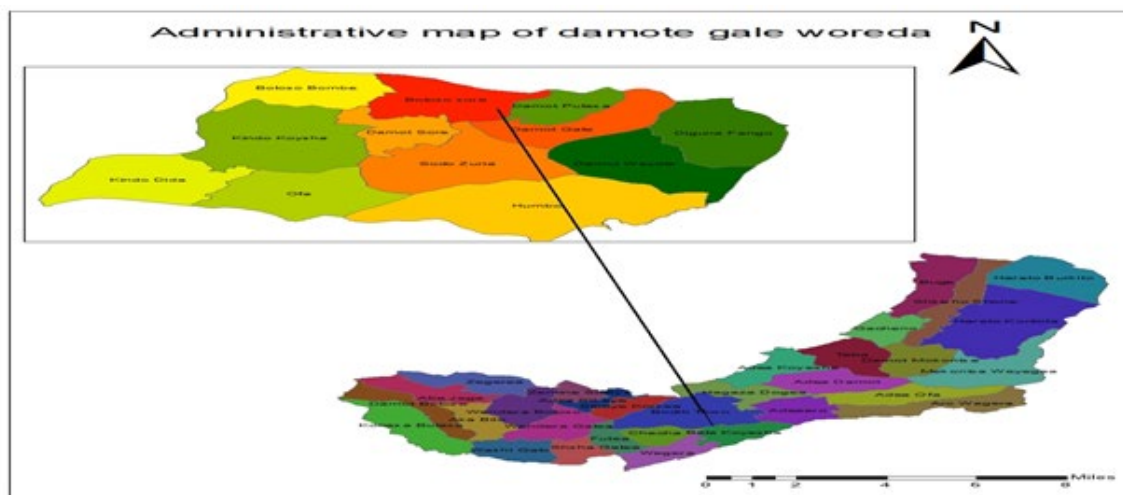
sults in itching, burning, erythema and oozing 12-48 hours later [9].

Unusual skin condition was noticed by Boditi health center health professionals and subsequently the situation was officially disclosed by boditi health office to Wolaita zone health department on 3/8/2018. Zonal health department sent a RRT that included physicians, public health officers and residents field epidemiology to investigate the outbreak, to identify risk factors and propose appropriate control measures.

## Methods and Materials

### Study Area

The study was conducted at boditi town administration. It is located 18 km North to Wolayita zone, Sodo town. Boditi town administration health Office comprises of 1 primary Hospital, 1 Health center (HC), 3Health posts (HP), & 5 private health sectors which were reporting regularly making the potential health coverage of the town administration to be 100 %in the year 2017 [10].



**Figure 1:** Administrative map of Boditi town administration, Wolaita Zone, South Ethiopia, 2018.

### Study Design

We conducted a descriptive study followed by unmatched case-control.

### Study Period

Data were analyzed from the beginning of the outbreak, from April 5 to 14, 2018 G.C.

### Data Dissemination

Written report (both hard and soft copies) was prepared and shared to Boditi town administration, Wolaita Zonal health department, Hawassa University School of Public Health Resident advisors and coordinators and for South Ethiopia Health Bureau of PHEM.

### Sample Size

Unmatched case-control study in the ratio of 1:2 (45 cases-90 controls) was conducted.

### Operational Definition

#### Cases

All cases of Nairobi fly dermatitis, in which the diagnosis was established clinically with a detailed history and dermatological examination, characterized as linear dermatitis, kissing/mirror image/ lesions, multiple vesiculo-pustular lesion, extensive pustules, Blistering and papulo-pustular lesions over face, neck, arms, shoulders, axillaries region, lower limbs, chest, upper limbs or any other area of the body with or without history of contact with insect in patients that live in or have visited boditi health center since April 5-14, 2018.

#### Controls

Any person in the area without signs or symptom of the disease during the study period

### Selection of Cases and Controls

Patients with peculiar skin infections were taken from boditi health center and using house to house visit in the affected Village from April 05-14/2018. Necessary information was taken from all eligible cases. Controls were enrolled from the commu-

nity in which cases were found. Controls were selected from the same households where cases were resides using lottery method. Where asymptomatic cases were not available, the next households were used to include in the control group.

### Inclusion Criteria

1. Cases Any residents of Ade charake village, who had symptoms of disease and agreed to participate.
2. Controls Any residents of Ade charake village during the study who was a neighbor to a case and who did not develop signs and symptoms of disease and agreed to participate.

### Exclusion Criteria

- Cases Those who refused to participate and other differentials of skin disease
- Control Those who refused to participate and did not fulfill inclusion criteria

### Environmental Investigation

We assessed the general living environment of cases and controls. In addition to this we assessed the possible Nairobi fly breeding sites within the community and nearby rivers, vegetation or fruits around the home, forest in the surrounding area, grassy land, hygiene and sanitation activities were assessed actively; especially poor housing condition such as broken doors and windows or not using screen in both, living condition in general observed and information obtained on other possible factors.

### Data Collection Method

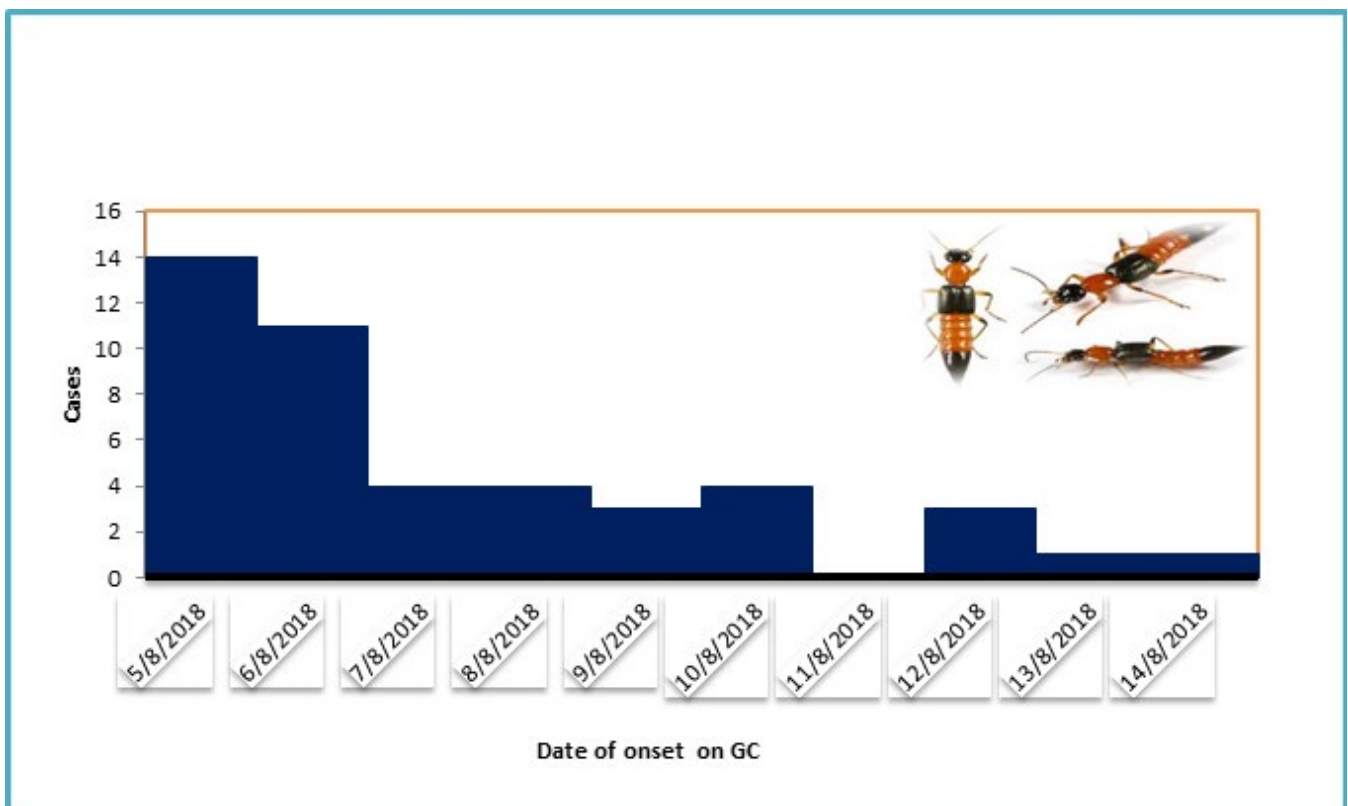
Registration book of the health center was reviewed retrospectively to observe if similar outbreak had occurred and to set background the status of the disease. Active case search was conducted using line listing of cases. Structured Interviewer administered questionnaires were used.

### Data Analysis

Data generated from the study were entered Epi- info version 7.0 and transferred to SPSS version 25 for analysis proportion, means, tables and graphs used for data summarization and presentation. Degree of association was measured by odds ratio with 95% confidence interval (CI). Logistic regression analysis was performed to identify the risk factors of the disease by controlling age, Sex and other socioeconomic variables.

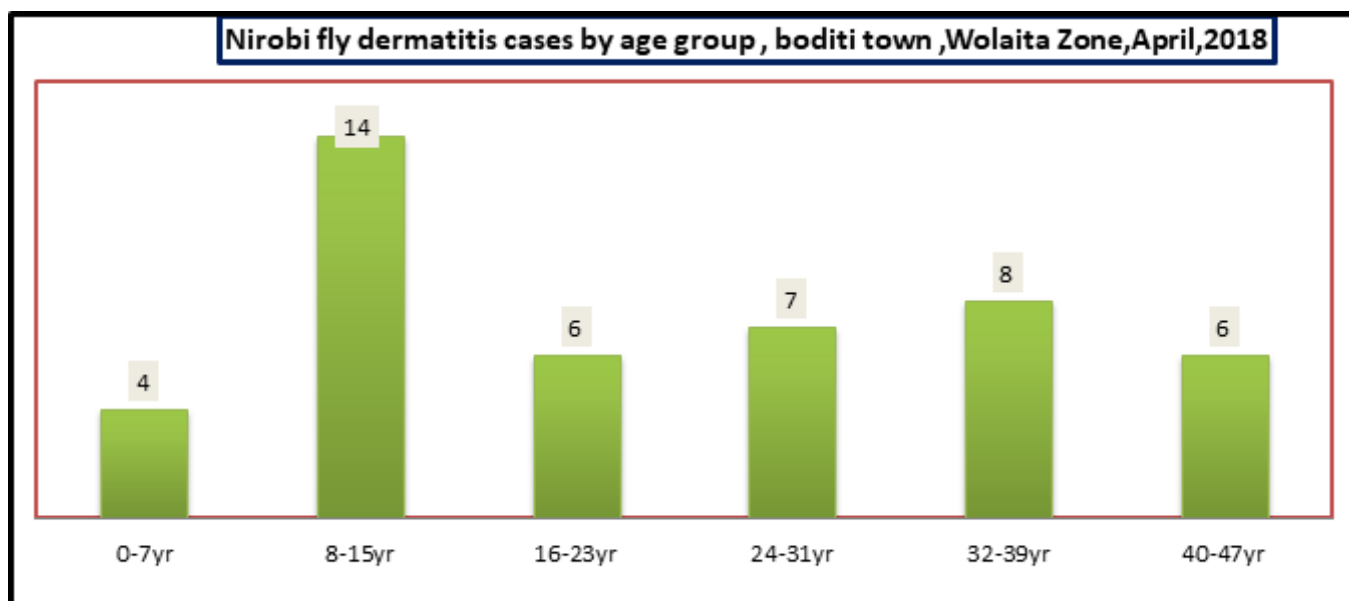
### Result

Totally 45 cases and no deaths were detected from April 05 to 14/2018 in Ade Charake village of Bodit town administration. The median age of the cases was 28 years old with a range of 1 to 60. Out of 45 total cases 27 (60%) were females and 18 (40%) males. All of the cases did not have travel history and the disease was not reported in that kebele ever before. Both the cases and controls of this study did not know the cause, transmission, prevention and treatment of the disease.



**Figure 2:** Distribution of Nairobi fly dermatitis suspected cases by date of disease onset in Ade Charakekebele of Bodit administrative town, Wolaita zone, South Ethiopia, April 5-14, 2018.

The onset of the outbreak was on April 5/2018. Peak cases were seen in the onset but dropdown diminishingly in similar fashion, until 16/2018. All cases were found in one kebele and had epidemiologically linked.



**Figure 3:** Distribution of Nairobi fly Cases by age group, Bodit town administration, Wolaita Zone, South Ethiopia, April 5-14, 2018.

The majority of patients were in the age group 8-15 years (AR=31%) affected and 0-7 years old were least (8.8%) affected age group.

Of the 45 patients, 32 patients (71 %) and 28(62%) were symptomatic with sensations of burning and itching, the burning sen-

sation was more pronounced compared to itching. Clinically most patients had periorbital Conjunctivitis 17(37.7%). Vesicular postular lesions were present in 10 patients (22%). A striking feature was the presence of numerous Erythmato-vesicular lesions in 18 patients (40 %). None of the patients had exhibited residual effect of the skin due to the fly.

**Table 1: Clinical presentations of Nairobi fly dermatitis, Bodit administrative town, Wolayita Zone, South Ethiopia, April 2018**

	Clinical presentation	Frequency	Percent	
1	Burning sensation	Yes	32	71.1
		No	13	28.9
2	Itching	Yes	28	62.2
		No	17	37.8
3	Conjunctivitis	Yes	17	37.8
		No	28	62.2
4	Erythmatovesicular	Yes	18	40.0
		No	27	60.0
5	Erythmatous	Yes	15	33.3
		No	30	66.7
6	Vesicular postular	Yes	10	22.2
		No	35	77.8
7	Blister	Yes	16	35.6
		No	29	64.4
8	Others	Yes	6	13.3
		No	39	86.7

Regarding the clinical findings of this study, all of the cases were observed on the exposed parts of the body. The majority 23 (51.1%) and 22(48.9%) of the lesion occurred on Neck and the faces respectively. Genitalia were the list exposed site which accounts 1(2.2%) and 3(6.7%) respectively. Number of lesion

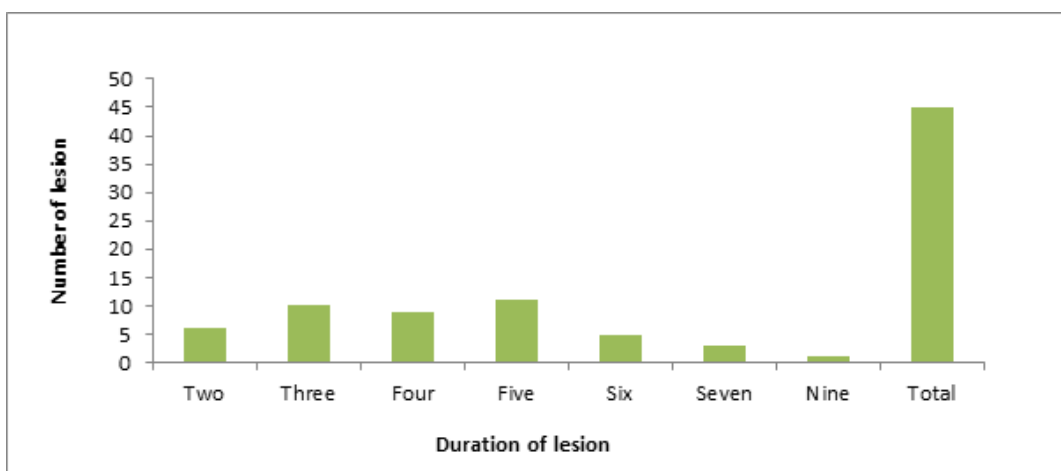
ranged from 1 to multiple (more than 5). Mostly, a two lesions were found in 17(37.8%) of the cases, followed by one lesion which was 13(28.9%) of the cases, the remaining 3-5 lesions accounted only 15 (33.3%) of the total cases.

**Table 2: Distribution of lesions anatomically in cases, Bodit administrative town, Wolaita Zone, South Ethiopia, and April 2018**

Site of lesions		Frequency	Percent
Face	Yes	22	48.9
	No	23	51.1
Neck	Yes	23	51.1
	No	22	48.9
Axillaries	Yes	7	15.6
	No	38	84.4
Upper limbs	Yes	6	13.3
	No	39	86.7
Shoulder	Yes	10	22.2
	No	35	77.8
Chest	Yes	3	6.7
	No	42	93.3
Genitalia	Yes	1	2.2
	No	44	97.8

Mean duration of the symptoms manifestation were 3 to 5 days.

**Table 3: Duration of lesion in affected cases by Nairobi fly dermatitis, Bodit town administration, Wolayita Zone, South Ethiopia, April 2018**



**Analytical Investigation**

Multivariate analysis results showed that Proximity of dense vegetations or fruit trees, habit of leaving night lamp on while sleeping had statically significantly associated with contracting Nairobi fly dermatitis. Those individuals whose houses were in

habit of leaving night lamp on while sleeping are 8.47 (95% CI 1.033-64.8) times more likely to develop Nairobi fly dermatitis than their counterparts, Proximity of dense vegetations or fruit trees 7 (95% CI 1.143-43.78) times more affected than those did not.

**Table 4: Multivariate logistic regression analyses of factors that have been associated with the development of lesions in Bodit town, Wolaita Zone, South Ethiopia, April 2018**

Variables		Case	Control	AOR(95%CI)	P-value
In habit of leaving night lamp on while sleeping	Yes	38	52	8.47(1.033-64.8)	0.047
	No	7	38	1	
Proximity of dense vegetations or fruit trees?	Yes	43	57	7.073(1.143-43.78)	0.035
	No	2	33	1	
Disposing wastes near vicinity	Yes	39	87	5.44(2.094,14.1250)	0.001
	No	6	13	1	

### Nairobi Fly Dermatitis Outbreak Investigation

Some of the Nairobi fly dermatitis cases in Ade charake village in Bodit town administration, Wolaita Zone, SNNPR, Ethiopia, 2018

### Discussion

The name ‘Nairobi fly’ is applied to *Paederus sabaues* Erichson and *Paederus crebrepunctatus* that both cause dermatitis and conjunctivitis in East Africa [3]. Nairobi fly dermatitis may affect people of any sex, age, race or socioeconomic status. The risk depends on the person’s activities and the insect habitat, exposed skin areas are at higher risk [11]. Nairobi fly dermatitis occurs predominantly on exposed parts of the body. Specially, face and neck were found to be the most commonly involved sites. Our study also found the dermatitis more commonly over uncovered parts of the body; the majority of the lesions were on the neck and face. Facial lesions had predilection for the periorbital region in 17(37.8%) percent of patients [12].

The increase in the *Paederus* sp. population and the increased dermatitis cases have been shown to occur during the rainy season. In similar study, *Paederus* dermatitis and conjunctivitis occurs mainly during the rainy season (March and October) in the north (Kilimanjaro and Arusha). Maximum cases reported in the month of April [6, 13]. This study suggested that females were more affected than males which are similar with the study done in Gurgaon [14]. However in other studies that were done in Province of Darien, Panama male sexes were more affected than their counterparts [13]. Though all ages, 8-15 years were affected more. This could be due to that older people may be more resistant to the bites than younger children and the young have more outdoor activities which more exposes to the bites of sand flies. Most of the cases had two lesions which are dominantly found on neck and face of the cases which is similar with the study that was conducted in panama [14]. Those individuals whose houses were in habit of leaving night lamp on while sleeping are 8.47 (95% CI 1.033-64.8) times more likely to develop Nairobi fly dermatitis than their counter parts, Proximity of dense vegetations or fruit trees 7 (95% CI 1.143-43.78) times more affected than those who did not. The same study done on Sierra leone, showed that lamp on while sleeping significantly associated with contracting Nairobi fly dermatitis [12].

Ecological changes and climatic variations, such as El Niño, have also led to the appearance of unusual outbreaks of dermatitis caused by some species of these insects, which increase year

after year in some regions worldwide [11, 15]. Global warming can also lead to increased incidence of *Paederus* sp. since higher temperatures may influence the ecological dynamics of some insect species. The increases in *Paederus* sp. populations and the dermatitis case reports in this outbreak could be due to climatic changes related to the onset of the rainy season; unfortunately, due to the limitation of current study, such variables were not available during the outbreak period in order to correlate them with the case incidence [16]. Heavy rainfall and consequently the increase of vegetation in deforested areas and along with the change in temperature and humidity cause an alteration in the natural habitat of these insects [17]. This may leads to the migration and proliferation of these insects to more urbanized areas, especially where there is artificial light [18-19]. Nairobi fly dermatitis outbreak was the new event in Bodit town administration and the community did not know the name of the disease, cause, transmission, prevention, control and treatment of the disease, before investigation. Some of them believe that the disease is caused as a result of sin and others thought that the transmission is due to contact. Due to these perceptions they discriminate cases and the cases affected psychologically. However, the limitation of this study was unavailability of expert dermatologist, laboratory investigation and entomological survey. Recall bias was also one limitation to remember onset of the date.

### Conclusion

Nairobi fly dermatitis is an uncommon condition but, can be prevented by increased public awareness. Inhabit of leaving night lamp on while sleeping, the proximity of dense vegetations or fruit trees and disposing wastes near vicinity significantly associated with Nairobi fly dermatitis. We conducted a series of awareness campaigns in and around the affected kebele stressing on the simple preventive measures based on the behavioral pattern of this nocturnal beetle, leading to a significant reduction in the incidence of disease. Health professionals in the affected areas should also be enlightened of this condition and its management. Awareness about the morphological patterns of the condition and its clinical features will prevent misdiagnosis.

### List of Abbreviations

AOR: Adjusted Odds Ratio, AR: Attack rate, CI: Confidence Interval, COR: Crude Odds Ratio, HC: Health Center, HP: Health Post, PHEM: Public Health Emergency Management, RRT: Rapid Response Team, SPSS: Software Package Social Sciences.



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## Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Ethics Approval and Consent to Participate

All participants were informed about the objective of the study, confidentiality of the participants were assured and informed consent was sought from and given by the participants, with the knowledge they were free to withdraw at any time. Ethical clearance was obtained from the institutional review board of Hawassa University, College of health sciences and the support letter was written from Wolayita Zone health department to Boditi town administration.

## Competing Interests

The authors declared that there is no competing interest.

## Consent for Publication

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