BEDBUG (*CIMEX LECTULARIUS*) INFESTATION AND ITS CONTROL PRACTICES IN TWO SELECTED SETTLEMENTS IN ILORIN, KWARA STATE, NIGERIA

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ABSTRACT

Bedbugs are cosmopolitan insects of public health importance. Their characteristic biting and blood feeding activities result in both physical symptoms and psychological distress in affected hosts. This study investigated the incidence of bedbug and control practices among students and indigenes living in two different settlements in Ilorin, Nigeria. Bedbug were surveyed and collected from household materials from fifty apartments randomly selected from each of the new and old student hostels and family houses in Tanke and Oja-Oba area of Ilorin. Bedbugs collected were persevered in 70 % alcohol and identified using taxonomic keys. A structured questionnaire was used to obtain information on respondent's demography, perception about bedbug infestation and control practices in sampled houses in the study areas. Sampled data were analysis using percentages. Results from the survey revealed that the number of respondents with knowledge of bedbug was not significant (p>0.05) compared with those without. Family houses in indigenous Oja-Oba study location were the only site with bed-bug infestation. Higher numbers of bedbugs were collected on mattresses. Out of the 200 respondents, 20 (10 %) employed the use of chemical method in bedbug control and precisely, 12 (60 %) of these use a locally made formulation named otapiapia. The intensity of infestation in Oja-Oba and insignificant knowledge of bedbug among the respondents suggest the need to raise the level of public awareness and also canvass for an improved living conditions in the affected areas.

Keywords: Bedbug, *Cimex lectularius*, Infestation, Control practices, Ilorin

INTRODUCTION

Bedbugs are small parasitic insects with a high nuisance value especially in unhealthy environment. Its interaction with man poses a public health challenge due to its characteristic and continuous biting and blood feeding ability. Frequent bedbug bites have been known to result in both physical symptoms such as allergic conditions, rashes and several health effects (Wong *et al.,* 2013). The bites are also known to induce psychological distress which includes nervousness and sleeplessness in infected hosts (Doggett *et al.*, 2004). Bedbugs are nocturnal, haematophagous and are flat when not engorged with blood (Munoz-Price *et al.*, 2012). They primarily, live in hidings or crack in furniture, beddings, curtains and walls (Gbakima *et al.*, 2002) during the day and appear at night to feed on their host (Hwang *et al.*, 2005). They are attracted mainly to carbon dioxide, body heat and other ill-defined olfactory

cues (Munoz-Price *et al.*, 2012). Exposure of humans to bedbugs over a long period of time is also known to lead to major blood loss in children leading to anaemia (Bonnefoy *et al.,* 2008). *Cimex lectularius* for example are known to have no particular biting preference with regards to humans of any age group, ethnicity and gender (Bonnefoy *et al.*, 2008). The bug has five stages in its development to adulthood. Even though blood meals are required for progression of the nymphal stages, adults can live for several months without any blood meals and can normally live for up to 2 years (Munoz-Price *et al.*, 2012). Under optimal conditions, the adult bedbug feeds once a week and the female bedbugs produce an average of 5 – 8 eggs per week for a total of 18 weeks (Onah *et al.*, 2014). Bedbug infestation has not been known to cause death, but the stigma and irritations associated with its bite and resistance to several classes of pesticides (Goddard and deShazo, 2009) have often led to the choice of toxic and use of higher dosages of pesticides in order to control them. This has often resulted to medical conditions attributable to undue pesticide exposure in man (Bashir *et al.*, 2013).

Bedbug are cosmopolitan and two species have been linked with humans, *Cimex lectularius*; found in the tropics (Armstrong and Cohen, 1999) and *Cimex hemipterus;* the main species in the subtropical region (Usinger, 1966). Infestations are common in the developing world (Hwang *et al.*, 2005) because it is aided by unsanitary living conditions and uncontrolled crowding (Bonnefoy *et al.*, 2008). In the 1980s, bedbugs were considered relatively uncommon in many developed countries, probably due to better building practices, better education and emphasis on wide use of insecticides (Potter, 2008), but recent studies have reported a resurgence and increase in bedbug infestations in developed countries (Adelman *et al.*, 2013; Angelakis *et al.*, 2013; Onah *et al.*, 2014). For instance in the United States, bedbugs were reported to have been completely eliminated in the 1940's. However, the recent immigration drift of displace persons from developing countries to developed countries have been attributed as one of the reasons responsible for its resurgence (Bonnerfoy et al., 2008; Goddard and deShazo, 2009; Delaunay, 2012). According to Omudu (2008), an increasing poor attitude towards housekeeping and poor hygiene has been mentioned as one of the several factors responsible for high infestation in two Nigerian cities; Makurdi and Otukpo. Similar prevalence of bedbug infestations in the US is also associated with resident's socio-economic status as revealed by previous surveys of low-income, middle-income and upper-income communities (Wang *et al.*, 2010, Wong *et al.*, 2013).

Bedbugs have been found to naturally carry many human pathogens including, bacteria, viruses, protozoa and parasitic worms (Ratnapradipa *et al.*, 2011), prompting numerous authors to postulate their risk to transmit pathogens to humans (Goddard and deShazo, 2009). However, they are not known to transmit any communicable disease (Onah *et al.*, 2014). Consensus on their medical impacts remains limited to dermatological reactions (Tharakaram, 1999) irritations, allergic reactions leading to loss of sleep and iron deficiency in children (Doggett *et al.,* 2012). Secondary bacterial infections such as cellulitis, impetigo, ecthyma, lymphangitis and folliculitis as a consequence of the scratching of the bedbug bite site have been reported (Doggett *et al.*, 2012). More importantly, skin reactions constitute the main clinical impact of bedbugs (Munoz-Price *et al.*, 2012).

Bedbug infestation is widespread as the insect is cosmopolitan (Delaunay *et al.*, 2011), however there is little documented evidences on the rate of infestation in Nigeria. Of the documented studies from Lagos, southwest Nigeria, Okwa and Omoniyi (2010) reported infestation rates of 50 % and above in two of the five studied communities in south-west Nigeria. Likewise in Benue, North Central, Nigeria, Omudu and Kuse (2010) reported that 62.2 % of the surveyed houses were infested with bedbugs. Heavy infestation has also been reported in homes and school hostels (Omudu, 2008). To our knowledge, there exist a dearth of knowledge on bedbug infestation in Ilorin and

its environs. This study investigated the knowledge, attitude and control practices of bedbug infestation among indigenes and highly mobile students in two selected communities in Ilorin, north central Nigeria.

MATERIALS AND METHODS

Study Area and Population: Ilorin is a town located in Kwara state, North-Central Nigeria. It also doubles as the capital of the state. It is located on latitude $8^o30'N$ and longitude $4^o33'E$. The city covers an area of about 765 km^2 and had a population of 777,667 as at 2006 making it the 6th most populous city in Nigeria (Wikipedia, 2017). Majority of the inhabitants engage in trade and it's the commercial nerve centre of the state. It houses almost all the major government buildings and activities and serves as the major centre for higher institutions in the state. It attracts many visitors and the inhabitants comprises majorly of Yoruba with significant presence of other ethnic groups; Fulani, Hausa, Nupe and Igbos. The city has two seasons; wet and dry season. The annual rainfall ranges from 1000 and 1500 mm usually between the month of April and October. The temperature of the city ranges between 19 and 35.9^oC with an average minimum and maximum relative humidity of 46 and 83 % (Wikipedia, 2017). Considering, the association between infestation and other factors such as movement of individuals, transportation, accommodation, dwellings and social status, the target group considered students living in hostel accommodation and non-student or local indigenes living in Ilorin. The hostels were mostly modern buildings providing accommodation for University of Ilorin students. The non-student target in this study were two populations of local indigenes located closely in Tanke and farther away from student hostels in Oja-Oba.

Sampling Techniques: Consent was obtained from community, household heads, owners/occupants of hostels marked for sampling and Ministry of Health, Ilorin. Samples were collected from houses selected from random numbers. This included fifty old

hostels, fifty new hostels, fifty family houses in Tanke and fifty family houses in Oja-Oba. Handpicking and brushing were employed to thoroughly inspect bed frames, mattresses, pillows, bed sheets, mosquito nets and cracks/crevices in walls. Points were bedbugs were removed was noted and signs of infestation were identified with the presence of empty egg cases and black faecal stains (Omudu and Kuse, 2010) on the mattresses, pillows and walls. Eggs and bedbugs collected were preserved in 70 % alcohol and transported to the Entomology Laboratory, University of Ilorin for identification using the taxonomic key of Yoloye (1994).

Questionnaire Administration and Analysis: Structured questionnaire were used to obtain information on respondents demography, perception about bedbug infestation and control practices in sampled houses in the study areas. Sorting and coding of the questionnaires were done and analyses of data were done using SPSS version 21.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

Knowledge and Attitude of Residents about Bedbug and Infestation: Results from the survey revealed that 110(55 %) of the respondents had knowledge of bedbug and have seen it before, however, only 20(10 %) of the surveyed apartment had bedbugs and signs of bedbug infestation. The 20 apartments constituting 40 % of all apartments surveyed in Oja-Oba were residence of indigenes. Signs of bedbugs infestation were not found at all of the apartments in the other three studied locations (new hostels, old hostels and Tanke). Also, inhabitants of the 20 infested home attributed the sources of bedbugs to house-to-house movement 9(45 %) and second hand furniture 4(20 %), while 7(35 %) of the inhabitants had no idea of the source of infestation (Table 1).

Number and Distribution of Bedbugs Collected on Household Materials: A total of 69 bedbugs were collected from 20 out of the 50 households surveyed at Oja-Oba, while

Table 1: Knowledge and attitude of respondents to bedbug infestations in Ilorin, Nigeria

Knowledge and attitude of respondents	Response
Have you seen bedbug before	
Yes	110(55)
No	90(45)
Total	200
Presence of bedbug in home	
Yes	20(10)
No	180(90)
Total	200
Knowledge of source of infestation	
House-to-house movement	9(45)
Second hand furniture	4(20)
Don't know	7(35)
Total	20

Number in parenthesis = percentage

sampled households at Tanke, new hostels and old hostel were completely free from bedbugs (Table 2). Record of examination of beddings mattresses, pillows and wooden bed frames, wooden furniture and wall cracks in the 20 infested households yielded a total of 111 household items comprised of 20(18 %) mattresses, 14(12.6 %) pillows, 20(18 %) wooden bed frames, 37(33.4 %) wooden furniture and 20(18 %) wall cracks. Out of these, only 29(26.4 %) items were infested. The distribution of household items observed to be infested with bedbugs were mostly mattresses 20(70 %) followed by wooden furniture 5(17.2 %), pillows 2(6.9 %) and wooden bed frames 2(6.9 %). A total of 69 bedbugs were collected from 29 infested items and identified as *Cimex lectularius*. Most of the bedbugs, 50(72.5 %) were collected on mattresses followed by the wooden furniture 12(17.4 %), pillows 3(4.5 %) and wooden bed frames 4(5.8 %) (Table 3).

Bedbug Control Practices: The bedbug control practices were categorised into chemical and non-chemical methods. The chemical methods basically involve use of insecticides. Three insecticides; Otapiapia (a locally diluted form of 2,2 dichlorovinyl 2, 4 dimethyl phosphate), Raid (1R-trans phenothrin and

prallethrin) and Rambo (pyrethroids) were used by residents of the study locations. The non-chemical methods mentioned are; handpicking of bedbugs, general house cleaning and sun drying of infested materials. Out of the 200 respondents, 20(10 %) employed the chemical method in bedbug control, while 40(20 %) used the non-chemical method and the remaining 140(70 %) respondents did nothing to control bedbug infestations. Out of the total respondents (20) who had bedbug infestation, precisely, 12(60 %) used otapiapia. Both Raid and Rambo aerosols were each used by 4(20%) of the respondents. Out of the 180 respondents that reported to have used non chemical means in protecting against *C. lectularius* infestation 20(11.1 %) of the respondents each used hand picking method and sun drying of infested materials. None of the respondents did general house cleaning to control bedbug infestation (Table 4).

DISCUSSION

This study addressed the knowledge, attitude and control practices of residents of Ilorin, Kwara state, Nigeria to bedbug infestation. Out of the 200 respondents selected in 4 study locations, only 55 % were capable of recognising bedbug. This showed that larger percentage of the residents were capable of identifying bedbug, however the difference in the numbers of individuals capable of identifying and not identifying bedbug was not significant (p>0.05). This suggested the need for more awareness and public enlightenment campaign on bedbug identification among the public. This is very important because pest identification is the first key step in integrated pest management (Anderson and Leffler, 2008). Out of the 200 households that were examined for bedbug infestations, only 10 % of the houses were infested and infested houses were found in only one of the four studied locations. Hostels belonging to students and indigenes living in the University student dominated area, Tanke, were infestation-free.

Table 2: Bedbugs (*Cimex lectularius*) collected from two selected settlements in Ilorin, Kwara State, Nigeria

Study Location	Occupants	Number of apartments surveyed	Number of apartments infested	Number of bedbugs collected		
				Male	Female	Total
New hostel	Student	50	0	0	0	0
Old hostel	Student	50	0	0	0	0
Tanke	Indigene	50	0	0	0	0
Oja-Oba	Indigene	50	20	25	44	69
Total		200	20	25	44	69

Table 3: **Distribution of bedbugs in different household items in infested homes from two selected settlements in Ilorin, Kwara State, Nigeria**

Location where bedbugs were found in homes	Number of items inspected	Number of items infested	Number of bedbugs collected
Beddings			
Mattress	20(18)	20(70)	50(72.5)
Pillow	14(12.6)	2(6.9)	3(4.5)
Wooden bed frame	20(18)	2(6.9)	4(5.8)
Wooden furniture	37(33.4)	5(17.2)	12(17.4)
Walls	20(18)	0(0)	0(0)
Total	111	29	69

Number in parenthesis = percentage

Table 4: Bedbug control methods practised by residents of two selected settlements in Ilorin, Kwara State, Nigeria

Control methods	Number of households
Chemical method	
Otapiapia	12(6)
Raid	4(2)
Rambo	4(2)
Non chemical methods	
Sun drying of infected	20(10)
General house cleaning	0(0)
Handpicking	20(10)
No Control measure	140(70)
Total	200

Number in parenthesis = percentage

This was contrary to reports from Lagos, south-west, Nigeria (Okwa and Ominiyi, 2010), Gboko (Omudu, 2008) and Gbajima (Omudu and Kuse, 2010) in Benue, North-Central, Nigeria, where infestation rates was high; ranging between 6.3 and 53 %. However, Oja-Oba studied location dominated by indigenes had an infestation rate of 40 % comparable to those reported. The higher level of infestation at Oja-Oba therefore agreed with infestation rates reported in Benue, North Central Nigeria (Omudu, 2008; Omudu and Kuse, 2010). Often times, infestation is associated with poor living conditions described by overcrowding, unhealthy environment and type of housing. This is seemingly true in the study area we have considered. Tanke studied location was inhabited by indigenes, the location was not overcrowded and has recently built and well-spaced building compared to the high density and higher frequency of old buildings in Oja-Oba. Albeit, Bonnefoy *et al*. (2008) stated that bedbug infestation was not related to poverty but to other factors such as poor house-keeping, unhealthy sanitary condition, overcrowding of apartment and poor housing pattern and mobility of infested individuals from one location to another could contribute to the rate of infestation within communities. This may significantly connote that, poor communities lack the resources needed to control bedbug infestations, thereby making the bugs prevalent and persistent in such areas. Also, majority of the respondent from the 20 infested houses

think house-to-house movement of individuals was the major source through which bedbugs were transferred from one apartment to another. This concurred with the findings of Hwang *et al.* (2005) that suggested that bedbugs can spread from shelter to shelter, presumably transported in the personal belongings of residents, and also in line with the report of Omudu and Kuse (2010). The use of second hand furniture was also identified as a source of infestation.

Most of the bedbugs were collected from beddings in the household with the mattresses harbouring 50 out of the 69 bedbugs. The preference for this location was significant to the coining of the name bedbug and offers the most vantage opportunity to for their night-time blood feeding activities (Omudu and Kuse, 2010). Pillows, wooden bed frame and wooden furniture were the other items harbouring these insects, while none was found in wall cracks.

Most of the respondent do not control bedbug due to the absence of infestations but the control methods employed by respondents with infested homes ranges from use of chemicals (Insecticides) to non-chemical methods. It should be noted that infestations are difficult and costly to eradicate but pest control experts have suggested a combination of insecticide treatment and environmental measures for adequate control of bedbugs (Munoz-Price *et al.*, 2012). Prominent insecticides brand employed are different aerosols brand (Raid, Rambo) and the more cheaper and readily available locally formulated brand dichlorvos called otapiapia. Otapiapia is perceived to be more potent than all other conventional insecticides. Preference for this locally formulated brand containing dichlorvos has also been established in the reports of Omudu and Kuse (2010) and Onah *et al.* (2014). Use of insecticides have been one of the most common means employed in controlling bedbugs (Davies *et al.*, 2012) but issues regarding toxicity and insecticide resistance (Bonnefoy *et al.*, 2008) have generated concerns in some spheres. Also, it was observed that majority of the respondents from the

infested homes engage in sun drying of infested household items as well as handpicking of insects. Infestations by *C. lectularius* are difficult to control because of the resistance to commonly used pesticides (Davies *et al.*, 2012) and their furtive behaviour, which usually conceals their presence within the environment. Therefore, interventions aimed at controlling this pest should be implemented by an experienced and certified pest control management service (Munoz-Price *et al.*, 2012).

The impact of bedbug infestation in homes cannot be ignored. The nuisance caused by its bite results in sleeplessness, anxiety, stigmatization and insomnia (Onah *et al.*, 2014). Considering the level of infestation in some part of Ilorin, residents need to be enlightened and encouraged on proper hygiene and sanitation. Also, periodic check and examinations needs to be incorporated into community health programmes by the government to contain spread from the infested communities to other areas. Lastly, further studies to establish all infested communities in the state need to be done and control measure set-up at the communities level to avoid the bedbug spread and increase in insecticide resistance after treatment of other communities.

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