



(RESEARCH ARTICLE)



## Prevalence and some associated symptoms of mosquito coil usage in Yenagoa Bayelsa State Nigeria

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### Abstract

Mosquito coils are insect repellents that are used mostly in Africa, sub-Saharan and some parts of the globe. This study was aimed on prevalence and some associated symptoms of mosquito coil usage in Yenagoa Bayelsa State Nigeria. One thousand four hundred and fifty one apparently healthy male and female volunteers within the age range of 20-50 years were recruited for this study after obtaining oral informed consent from each of them.. Among these volunteers, 527, 492 and 432 were from Agudama-Epie, Ede-pie and Akenfa communities in Yenagoa respectively. The data obtained from these volunteers via questionnaires which were analyzed using descriptive statistic of frequency and percentage revealed 403 (76) %, 365 (74) % and 324 (75) % as users of Read A Dream mosquito coil in the respective communities with 286 (71) %, 266 (73) % and 227 (70) % being unemployed while 264 (66) %, 247 (68) % and 203 (63) % are with no academic and/or professional qualifications. Symptom of throat irritation was manifested in 271 (67) %, 262 (72) % and 253 (78) % of these volunteers in the three communities respectively as compared with other symptoms such as cough, eye irritation, skin irritation, catarrh and headache which were not manifested. In conclusion, a high prevalence of Read A Dream mosquito coil usage was recorded in the three respective communities with unemployed apparently healthy volunteers as well as those with no academic and/or professional qualifications accounting for significant percentage while throat irritation was the only symptom manifested. It is therefore recommended that only mosquito coils certified safe for use by an appropriate authority should be sold in the market and used in accordance to prescribed safety precautions

**Keywords:** Prevalence; Symptoms; Usage; Mosquito coil; Yenagoa; Bayelsa State; Nigeria

### 1. Introduction

Mosquitoes belong to small flies made up of almost 3,600 species and have been identified for a very long time as the potential vectors responsible for human and animal diseases such as west nile virus, malaria and dengue [1]. As a result of this, many families have adopted different methods such as aerosols, mosquito coils, liquid vapourizers and vapourizing unit to control its spread around residential areas [2]. Among these different adopted methods, mosquito coils are mainly used, this may however be because they are cheaper and readily available [3].

Mosquito coils as the name implies are usually spiral in shape and are manufactured from powder of dried paste pyrethrum. They are mostly used at night while sleeping due to exposure to mosquitoes which is rampant and on the increase. These coils when burnt release mosquito repellent smoke which emits toxic heavy elements, allethrin, particulate matter, carbon monoxide, formaldehyde, polycyclic aromatic hydrocarbons (PAH) such as benzopyrenes, benzofluoroethane etc. This smoke when exposed to extensively may cause respiratory infection, cardiovascular disorder, renal disorder, hepatotoxicity [3] and infertility [4] in humans. It may as well induce cough, sneezing, itching, skin reaction and inflammation of trachea [5].

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The objectives of this study are as outlined below:

- To determine the prevalence of insecticides usage in Agudama-Epie, Ede-pie and Akenfa communities in Yenagoa LGA, Bayelsa State
- To determine the prevalence of monthly income of Read A Dream mosquito coil users in Agudama-Epie, Ede-pie and Akenfa communities in Yenagoa LGA, Bayelsa State.
- To determine the prevalence of educational status of Read A Dream mosquito coil users in Agudama-Epie, Ede-pie and Akenfa communities in Yenagoa LGA, Bayelsa State.
- To determine the symptoms associated with the use of Read A Dream mosquito coil in Agudama-Epie, Ede-pie and Akenfa communities in Yenagoa LGA, Bayelsa State.

Mosquito coils being insect repellents / insecticides protect humans against mosquitoes and in turn prevent malaria which is a public health problem reported to be responsible for the leading cause of death in many tropical countries especially in sub Saharan Africa. In 2016, four hundred and forty five thousand (445, 000) deaths were accounted for globally due to malaria, out of which 90% occurred in African region [6].

The scourge of this endemic parasitic infection accounts for 60% of outpatients visit to clinics in Nigeria. This situation has made many people in low income communities to embark on the routine and chronic use of mosquito coils so as to control the population of mosquitoes despite the fact that it is not one of the preventive measures recommended by World Health Organization (WHO) to curb mosquitoes [7].

It is in the light of this, that this study which aimed on the prevalence and some associated symptoms of mosquito coil usage in Yenagoa, Bayelsa State, Nigeria was embarked on.

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## **2. Material and methods**

### **2.1. Study area**

This research was done in three communities: Agudama-Epie, Ede-pie and Akenfa in Yenagoa LGA Bayelsa State, Nigeria

### **2.2. Ethical approval**

This study which got ethical approval from College Health Research Ethics Committee of Niger Delta University and carried out in compliance with the Principle of Helsinki declaration of 1975 as revised in 2008 also got the oral informed consent from all the volunteers and written informed consent from the respective paramount rulers of the three communities where the study was performed.

### **2.3. Data collection**

In this study data were collected via questionnaire from one thousand four hundred and fifty-one (1,451) apparently healthy volunteers in three communities: Agudama-Epie (527), Edepie (492) and Akenfa (432) in Yenagoa LGA, Bayelsa State Nigeria with a view to establish

- The residential insecticide that is mostly used in these respective communities.
- The symptoms that may be associated with the most used insecticide in these respective communities.

### **2.4. Statistical analysis**

The data obtained from the recruited volunteers via questionnaire were analyzed using descriptive statistic of frequency and percentage

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## **3. Results**

The data showing prevalence of insecticides usage among the apparently healthy volunteers in Agudama-epie community Yenagoa LGA, Bayelsa State Nigeria are shown in Table 1.

**Table 1** Prevalence of insecticides usage among apparently healthy volunteers in Agudama-Epie community Yenagoa LGA, Bayelsa State Nigeria

Community	Types of insecticides	Age (years)	Frequency of usage	Duration of usage	Pattern of usage	Exposure pattern	Period of usage	No. of users	Sex (M/F)	Overall %
Agudama-Epie	RAD	20-50	Daily	8 hours	Indoors	Whole body	≥ 1 year	403	310/93	76
(n=527)	OBMC	20-50	Daily	8 hours	Indoors	Whole body	≥ 1 year	67	42/25	13
	SNP	20-50	Daily	NS	Indoors	Whole body	≥ 1 year	29	17/12	6
	ITN	20-50	Daily	8 hours	Indoors	Whole body	≥ 1 year	17	10/7	3
	ISS	20-50	Daily	NS	Indoors	Whole body	≥ 1 year	11	8/3	2

KEYS: n= Number of volunteers, M/F= Male/female, RAD=Read A Dream mosquito coil, OBMC= Other brands of mosquito coil, SNP= Snipper, ITN= Insecticide treated bednet, ISS= Insecticide spray, NS= Not specific

The data from this Table 1 revealed that in Agudama-Epie community Yenagoa LGA Bayelsa State Nigeria out of the five hundred and twenty seven (527) apparently healthy volunteers that participated in this study, Read A Dream mosquito coil accounted for the most prevalently used insecticide (76) %, followed by other brands of mosquito coil (13) %, sniper (6) %, insecticides treated bednet (3) % and insecticide spray (2) % respectively.

The data showing prevalence of insecticides usage among the apparently healthy volunteers in Ede-pie community Yenagoa LGA, Bayelsa State Nigeria are shown in Table 2.

**Table 2** Prevalence of insecticides usage among apparently healthy volunteers in Ede-pie community in Yenagoa LGA Bayelsa State Nigeria

Community	Types of insecticide	Age (years)	Frequency of usage	Duration of usage	Pattern of usage	Exposure pattern	Period of usage	No. of users	Sex (M/F)	Overall %
Ede-pie	RAD	20-50	Daily	8 hours	Indoors	Whole body	≥ 1 year	365	287/78	74
(n=492)	OBMC	20-50	Daily	8 hours	Indoors	Whole body	≥ 1 year	67	39/28	14
	SNP	20-50	Daily	8 hours	Indoors	Whole body	≥ 1 year	42	29/13	9
	ITN	20-50	Daily	8 hours	Indoors	Whole body	≥ 1 year	12	10/2	2
	ISS	20-50	Daily	NS	Indoors	Whole body	≥ 1 year	6	4/2	1

KEYS: n= Number of volunteers, M/F= Male/female, RAD= Read A Dream mosquito coil, OBMC= Other brands of mosquito coil, SNP= Snipper, ITN= Insecticide treated bednet, ISS= Insecticide spray, NS= Not specific

The data from this Table 2 revealed that in Ede-pie community Yenagoa LGA Bayelsa State Nigeria out of the four hundred and ninety two (492) apparently healthy volunteers that participated in this study Read A Dream mosquito coil accounted for the most prevalently used insecticide (74) %, followed by other brands of mosquito coil (14) %, sniper (9) %, insecticides treated bednet (2) % and insecticide spray (1) % respectively.

The data showing prevalence of insecticides usage among apparently healthy volunteers in Akenfa community Yenagoa LGA, Bayelsa State Nigeria are shown in Table 3.

**Table 3** Prevalence of insecticides usage among apparently healthy volunteers in Akenfa community Yenagoa LGA Bayelsa State Nigeria

Community	Types of insecticide	Age (years)	Frequency of usage	Duration of usage	Pattern of usage	Exposure pattern	Period of usage	No. of users	Sex (M/F)	Overall %
Akenfa	RAD	20-50	Daily	8 hours	Indoors	Whole body	≥ 1 year	324	215/109	75
(n=432)	OBMC	20-50	Daily	8 hours	Indoors	Whole body	≥ 1 year	65	44/21	15
	SNP	20-50	Daily	NS	Indoors	Whole body	≥ 1 year	22	14/8	5
	ITN	20-50	Daily	8 hours	Indoors	Whole body	≥ 1 year	16	9/7	4
	ISS	20-50	Daily	NS	Indoors	Whole body	≥ 1 year	3	3/0	1

KEYS: n= Number of volunteers, M/F= Male/female, RAD= Read A Dream mosquito coil, OBMC= Other brands of mosquito coil, SNP= Snipper, ITN= Insecticide treated bednet, ISS= Insecticide spray, NS= Not specific

The data from this Table 3 revealed that in Akenfa community Yenagoa LGA Bayelsa State Nigeria out of the four hundred and thirty two (432) apparently healthy volunteers that participated in this study Read A Dream mosquito coil accounted for the most prevalently used insecticide (75) %, followed by other brands of mosquito coil (15) %, sniper (5) %, insecticides treated bednet (4) % and insecticide spray (1) % respectively.

The data showing the prevalence of monthly income of Read A Dream mosquito coil users in Agudama-Epie, Ede-pie and Akenfa communities in Yenagoa LGA, Bayelsa State Nigeria are shown in Table 4.

**Table 4** Prevalence of monthly income of Read A Dream mosquito coil users in Agudama-Epie, Ede-pie and Akenfa communities Yenagoa LGA Bayelsa State Nigeria

Monthly income	Agudama-Epie(n=403) N(%)	Ede-pie(n=365 N(%)	Akenfa(n=324) N(%)
Unemployed	286 (71)	266 (73)	227 (70)
<#50,000	107 (27)	92 (25)	82 (25)
#50,000 - #99,000	10 (2)	7 (2)	15 (5)
#100,000 - #149,000	0 (0)	0 (0)	0 (0)
≥ #150,000	0 (0)	0 (0)	0 (0)

KEYS: n = Number of the apparently healthy volunteers that use Read A Dream mosquito coil, N = Prevalence of monthly income of the apparently healthy volunteers that use Read A Dream mosquito coil.

The data from this Table 4 revealed that in Agudama-Epie community Yenagoa LGA Bayelsa State Nigeria out of the four hundred and three (403) apparently healthy volunteers that are users of Read A Dream mosquito coil 71 % are unemployed, 27 % are monthly earners of less than #50,000, 2 % are monthly earners of #50,000 to #99,000 while monthly earners above #100,000 were found not to use this coil.

The data from this Table 4 revealed that in Ede-pie community Yenagoa LGA Bayelsa State Nigeria out of the 365 (three hundred and sixty five) apparently healthy volunteers that are users of Read A Dream mosquito coil 73% are unemployed, 25 % are monthly earners of less than #50,000, 2 % are monthly earners of #50,000 to #99,000 while monthly earners above #100, 000 were found not to use this coil.

The data from this Table 4 revealed that in Akenfa community in Yenagoa LGA Bayelsa State Nigeria out of the three hundred and twenty four (324) apparently healthy volunteers that are users of Read A Dream mosquito coil 70 % are unemployed, 25 % are monthly earners of less than #50,000, 5 % are monthly earners of #50,000 to #99,000 while monthly earners above #100, 000 were found not to use this coil.

The data showing the prevalence of educational status of Read A Dream mosquito coil users in Agudama-Epie, Ede-pie and Akenfa communities in Yenagoa LGA, Bayelsa State Nigeria are shown in Table 5.

**Table 5** Prevalence of educational status of Read A Dream mosquito coil users in Agudama-Epie, Ede-pie and Akenfa communities Yenagoa LGA Bayelsa State Nigeria

Educational status	Agudama-Epie (n=403) N(%)	Ede-pie (n=365) N(%)	Akenfa (n=324) N(%)
≥ First degree	29 (7)	20 (5)	21 (6)
SSCE/WASC	53 (13)	40 (11)	49 (15)
Primary school certificate	57 (14)	58 (16)	51 (16)
No formal education	264 (66)	247 (68)	203 (63)

KEYS: n = Number of the apparently healthy volunteers that use Read A Dream mosquito coil, N = Prevalence of educational status of the apparently healthy volunteers that use Read A Dream mosquito coil, SSCE = Senior secondary school certificate examination, WASC = West Africa school certificate

The data from this Table 5 revealed that in Agudama-Epie community Yenagoa LGA Bayelsa State Nigeria out of the four hundred and three (403) apparently healthy volunteers that are users of Read A Dream mosquito coil 66 % have no formal education, 14 % are primary school certificate holders, 13 % are secondary school certificate/ West Africa school certificate holders while 7 % are with a minimum of first degree or its equivalent.

The data from this Table 5 revealed that out of the 365 (three hundred and sixty five) apparently healthy volunteers that are users of Read A Dream mosquito coil in Ede-pie community in Yenagoa LGA Bayelsa State Nigeria 68 % have no formal education, 16 % are primary school certificate holders, 11 % are secondary school certificate/ West Africa school certificate holders while 5 % are with a minimum of first degree or its equivalent.

The data from this Table 5 revealed that out of the three hundred and twenty four (324) apparently healthy volunteers that are users of Read A Dream mosquito coil in Akenfa community in Yenagoa LGA Bayelsa State Nigeria 63 % have no formal education, 16 % are primary school certificate holders, 15 % are secondary school certificate/ West Africa school certificate holders while 6 % are with a minimum of first degree or its equivalent.

The data showing manifested symptoms among users of Read A Dream mosquito coil in Agudama-Epie, Ede-pie and Akenfa communities in Yenagoa LGA Bayelsa State Nigeria are as shown in Table 6.

**Table 6** Manifested symptoms among users of Read A Dream mosquito coil in Agudama-Epie, Ede-pie and Akenfa communities Yenagoa LGA Bayelsa State Nigeria

Symptoms	Agudama-Epie (n=403) N(%)	Ede-pie (n=365) N(%)	Akenfa (n=324) N(%)
Cough	0 (0)	0 (0)	0 (0)
Eye irritation	0 (0)	0 (0)	0 (0)
Skin irritation	0 (0)	0 (0)	0 (0)
Throat irritation	271(67)	262 (72)	253 (78)
Catarrh	0 (0)	0 (0)	0 (0)
Headache	0 (0)	0 (0)	0 (0)

KEYS: n = Number of the apparently healthy volunteers that use Read A Dream mosquito coil, N = Number of apparently healthy volunteers showing symptoms associated with the use of Read A Dream mosquito coil.

The data from this Table 6 revealed the manifestation of 67 %, 72 % and 78 % symptom of throat irritation among the apparently healthy volunteers that use Read A Dream mosquito coil in Agudama-Epie, Ede-pie and Akenfa communities

in Yenagoa LGA Bayelsa State Nigeria respectively as compared to other symptoms such as cough, eye irritation, skin irritation, catarrh and headache which were not manifested.

#### 4. Discussion

Malaria is a public health problem of concern in developing countries particularly in Nigeria where it accounts for more cases of infection and death. In a bid to prevent or reduce this problem humans have resolved to use different control methods such as aerosols, mosquito coils, liquid vapourizers and vapourizing units to prevent mosquito bite which is the cause of malaria [8].

As shown in Table 1 the data revealed that in Agudama-Epie community in Yenagoa LGA Bayelsa State Nigeria; out of the five hundred and twenty seven (527) apparently healthy volunteers that gave their consent to this study, the users of Read A Dream mosquito coil were four hundred and three (403) which accounted for 76 % followed by users of other brands of mosquito coil (13) %, users of sniper (6) %, users of insecticides treated bednet (3) % and users of insecticide spray (2) % respectively. Irrespective of the fact that mosquito coils unlike insecticides treated bednet and insecticides spray are not recommended by World Health Organization (WHO) as one of the methods for malaria control. The finding as established in this study revealed a high prevalence usage of Read A Dream mosquito coil in this community. This may be due to its relatively tolerable / minimal side effects.

As shown in Table 2, the data revealed that in Ede-pie community in Yenagoa LGA Bayelsa State Nigeria out of the four hundred and ninety two (492) apparently healthy volunteers that gave their consent to this study, three hundred and sixty five (365) were found to be users of Read A Dream mosquito coil which accounted for 74 % followed by users of other brands of mosquito coil (14) %, users of sniper (9) %, users of insecticides treated bednet (3) % users of insecticide spray (1) % respectively. This finding which revealed a high prevalence usage of Read A Dream mosquito coil in this community as established may be attributed to its relatively tolerable / minimal side effects.

As shown in Table 3, the data revealed that in Akenfa community in Yenagoa LGA Bayelsa State Nigeria out of the four hundred and thirty two (432) apparently healthy volunteers that gave their consent to this study, three hundred and twenty four (324) are users of Read A Dream mosquito coil which accounted for 75 % followed by users of other brands of mosquito coil which accounted for 15 %, users of sniper (5) %, users of insecticides treated bednet (4) % and users of insecticide spray (1) % respectively. This finding as established in this study revealed a high prevalence usage of Read A Dream mosquito coil in this community irrespective of the fact that it is not a World Health Organization (WHO) recommended method for malaria control. This however, may be linked to its relatively tolerable / minimal side effects.

As shown in Table 4, the data from this study further revealed that out of the four hundred and three (403), three hundred and sixty five (365) and three hundred and twenty four (324) apparently healthy volunteers that are users of Read A Dream mosquito coil in Agudama-Epie, Ede-pie and Akenfa communities respectively 71 %, 73 % and 70 % are unemployed while 27 %, 25 % and 25 % are monthly income earners of < #50,000, 2 %, 2 % and 5 % are monthly income earners of #50,000 - #99,000. It has been established in this study that volunteers with monthly income above #100,000 rarely use Read A Dream mosquito coil in these respective communities. This study further established that users of this coil in Agudama-Epie, Ede-pie and Akenfa communities are mainly unemployed and low-income earners.

This finding as established in this study may be attributed to the fact that these coils are relatively cheaper and regularly available in market.

The data from this study as shown in Table 5 revealed that out of the four hundred and three (403), three hundred and sixty-five (365) and three hundred and twenty four (324) apparently healthy volunteers that are users of Read A Dream mosquito coil in Agudama-Epie, Ede-pie and Akenfa communities in Yenagoa LGA, Bayelsa State Nigeria respectively 66 %, 68 % and 63 % had no formal education. This finding as established in this study revealed that high percentage of users of this coil in these communities are of lower literacy level which may catalyze its indiscriminate usage. This therefore calls for more education of mosquito coil users, particularly in these respective communities about the health hazards of coils as well as safe practices in order to bridge this gap in knowledge.

The data from this study as shown further in Table 5 revealed that 14 %, 16 % and 16 % of the users of Read A Dream mosquito coil in Agudama-Epie, Ede-pie and Akenfa communities respectively are holders of primary school certificate, 13 %, 11 % and 15 % are holders of senior secondary school certificate/West Africa school certificate while 7 %, 5 % and 6 % are holders of minimum of first degree or its equivalent. These findings are as further established in this study.

The data from this study as shown in Table 6 revealed the manifestation of throat irritation symptom in 67 %, 72 % and 78 % of the apparently healthy volunteers that use Read A Dream mosquito coil in Agudama-Epie, Ede-pie and Akenfa communities in Yenagoa LGA, Bayelsa State Nigeria respectively as compared to other symptoms such as cough, eye irritation, skin irritation, catarrh and headache which were not manifested. This established finding is presumed to be triggered by the prolonged inhalation of the particulate matter generated from the burnt mosquito coil which contains heavy metals, allethrin and wide range of organic compounds [9] that are too tiny to be filtered in the respiratory tract, thus passing through to the throat where it may cause inflammation as well as allergic reaction which in turn may be responsible for the irritation.

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## 5. Conclusion

A high prevalence of Read A Dream mosquito coil usage was recorded in the three communities in Yenagoa with unemployed apparently healthy volunteers as well as those with no academic and/or professional qualifications accounting for significant percentage while throat irritation was the only symptom manifested among other symptoms such as cough, eye irritation, skin irritation, catarrh and headache.

### *Recommendations*

- Only mosquito coils certified safe for use by an appropriate authority should be sold in the market
  - Mosquito coils should be used in accordance to prescribed safety precautions
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## Compliance with ethical standards

### *Acknowledgments*

The paramount rulers of Agudama Epie community HRH Chief Titus Gospel Akputakpu, Akenfa community HRH Lusty Sylvanus Akpaloo and Ede-pie community HRH Edwin Iti Otom are most respectfully appreciated for giving us the approval to carry out this study in their respective communities. Also our wholehearted appreciation goes to all the volunteers for their innumerable cooperation

### *Disclosure of conflict of interest*

No conflict of interest

### *Statement of ethical approval*

All the authors were responsible for the entire concept of the research. The procedure adopted for this research was in compliance with the Principles of Helsinki declaration of 1975 as revised in 2008.

### *Statement of informed consent*

Informed consent was obtained from all the volunteers involved in the study

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