Journal of
Social Behavior and Community Health

Insect Stings and Bites: Teachers' Knowledge of Prevention and First Aid Treatment regarding Allergies and Anaphylaxis in Primary Schools in Nigeria

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[DOR: 20.1001.1.27832104.2023.7.1.6.4]
[DOI: 10.18502/jsbch.v7i1.12793]

ARTICLEINFO

ORIGINAL ARTICLE

Article History:
Received: 25 Jan 2023
Revised: 29 Apr 2023
Accepted: 01 May 2023

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Citation:
Samuel Adesina Okueso, Victor O. Adefarasin, Ridwan Ademola Adekola. Insect Stings and Bites: Teachers' Knowledge of Prevention and First Aid Treatment regarding Allergies and Anaphylaxis in Primary Schools in Nigeria. Journal of Social Behavior and Community Health (JSBCH). 2023; 7(1): 1000-1008.

ABSTRACT

Background: Insects' stings and bites are common phenomenon among school children in rural areas. Knowledge of teachers on allergies and anaphylaxis due to insect bites and stings is important to promote healthy school living; hence, this study investigated the knowledge of primary school teachers on stinging insects and allergic reactions.

Methods: Descriptive survey research design was used with 120 participants selected. Knowledge of insect stings prevention questionnaire (KISPQ r = 8.27) and knowledge of insect stings first aid treatment questionnaire (KISFATQ, r = 7.68) were the main instruments used for the study. Mean and standard deviation were used to answer the four research questions while linear regression analysis was used to test the two postulated hypotheses at 0.05 alpha levels.

Results: Findings revealed that teachers were not significantly knowledgeable about insects' stings regarding allergies and anaphylactic reactions. This was because only about 50% of the teachers could recognize the insects causing allergies and anaphylactic reactions. The result of F-value of 81.760 whose probability was close to zero percent showed that, statistically, the teachers' knowledge of the prevention and first aid treatment of allergy due to insect bite had a significant influence: $R = 0.640$, $R^2 = 0.409$; $F = 81.760$ $P < 0.05$ on prevention of anaphylaxis. The result of F-value of 110.618 whose probability was close to zero percent indicated that teachers' knowledge of an etiology and prevention of allergy regarding insect bite had a significant influence on first aid skills.

Conclusion: There is inadequate knowledge of primary school teachers on stings/bites and allergies. Allergies and anaphylactic prevention should be added to health education curriculum input in primary school.

Keywords: Prevention, First Aid, Insect Sting Allergy, Treatment

[DOR: 20.1001.1.27832104.2023.7.1.6.4]
[DOI: 10.18502/jsbch.v7i1.12793]

Introduction

The incidence of allergies has remained unresolved in our schools primarily as a result of lack of adequate knowledge of the various aetiological and predisposing factors responsible for this phenomenon on the part of learners, parents and teachers. There are several varieties of insects whose stings lead to allergic reactions and anaphylaxis in children at various locations in schools. They include school garden, playing field, classroom, toilet and other places in the school premises. The most common insects are: wasps (hornet vespas), yellow jackets (United States)/ wasps (Europe) (Vespula), and stinging ants (fire ants (Solenopsis), jack jumper and bull ants (Myrmecia), and (Pachycondila) (Ludman and Boyle, 2015). Some sting reactions are painful and irritating, they are easily resolved, and the effects are not devastating (Petel, Tan, & Levell, 2021. Boyd, Burns, Facep, 2021). Sadly, some children react more strongly to the extent that necessitates medical attention.

Anaphylaxis to an insect sting is classified not only on the foundation of cardio-respiratory reaction, but also by any abdominal cramps or vomiting. This is not like allergic reaction to food substance where gastrointestinal symptoms can be part of the nonanaphylactic reactions, since the gastrointestinal system is the site of allergen exposure (Bilo, Rueff, Mosbech, Bonifazi, and Oude-Elberink, 2005). Anaphylaxis to an insect sting can cause a terrifying and rapid death, with initial cardio-respiratory arrest within 5-10 minutes of the sting/bite in many of such cases (Whyte, Popescu, and Carlson, 2020, Pumphrey, 2000, Jones, Blair MacNeil, Welch, Hole and Baxter et al 2017). The likelihood of such anaphylactic incident causes significant anxiety and social restriction regarding an insect sting especially among children in the school premises for both parents and the teacher (Sabogal Lozano, Mercado, Cantillo, Moncada, Quinones, et al, 2019). The large order of insects called hymenoptera are commonly responsible for anaphylactic reaction (Helbling, Hurni, Mueller and Pichler, 2004; Gonzalez-Estrada, Silvers, Klein, Zell, Wang and Lang, 2017., Fehr, Miccaletto, Moehr and Schmid-Grendelmeier, 2019., Schiener, Graessel, Ollert, Schmidt-Weberand and Blank, 2017).

The symptoms of an insect sting allergic reaction include: shortness of breath, wheezing, coughing, pale skin, weak pulse, fainting, tight throat and difficulty in breathing, swelling of the lips and sometimes the tongue, hives and confusion. In the case of nonallergic children, symptoms include: swelling which may appear and disappear for about 48 hours, redness on the skin which can last for three days to one week with swelling, mild reactions like sneezing, itchy nose and mouth, a few hives or a stomachache (Caravedo-Martinez, Ramirez-Hernandez, and Blanton, 2021., American Academy of Pediatrics, 2018).

Anaphylactic reaction may occur with bee, wasp, fire ant stings, and yellow jacket. But, it is important to note that anaphylaxis is very rare for other species of insect bites. The expected courses of reaction with insect bites are: felling itchy for several days, redness for three days, and swelling for seven days. Bites of the upper face region may cause severe swelling around the eye which is usually worse in the morning as a result of lying down through night. Insect sting allergy happens to anybody at any age, and most of the times when there are multiple stings which are always the case. Systemic reaction is estimated to occur in 3% of adults, and approximately 1% of children have a medical history of severe sting reactions (Caravedo-Martinez, Ramirez-Hernandez, and Blanton, 2021, Golden, Demain, Freeman, Graft, Tankersley, M., Tracey et al, 2017).

The knowledge of first aid treatment of insect bite include reassuring both the child and parents that swelling and redness are normal inflammatory process which will subside; this does not meant that the spot is infected. For itchy insect bite, steroid cream can be applied, and in Nigeria, there are several anti-inflammatory antibiotic and anti-allergic three-in-one creams such as FUNBACT A.

[DOR: 20.1001.1.27832104.2023.7.1.6.4]
[DOI: 10.18502/jsbch.v7i1.12793]

Insect stings in school are not accurately reported to the local epidemiological units of the primary healthcare centers in Nigeria. But, some few cases discussed when cases become complicated (Jimoh, Akuse, Bugaje and Mayaki, 2016). It has been reported that between 90-100 deaths per year in Nigeria is the result of insect stings anaphylaxis (Greenstickeduation servies, 2023). Researchers in the field of health and medical science have not much focused on this area of concern, in spite of its poorly reported prevalence. Regarding teachers of health education who teach courses like allergies and its prevention in school, having adequate knowledge of allergies caused by stings is very important. Otherwise, poor reporting occurs. As against the background of this identified phenomenon and variables, the researchers investigated the phenomenon to raise awareness for intervention in these areas.

Methods

Descriptive survey research was adopted for this study with 390 teachers in the primary schools of rural Ogunwaterside local government area in Ogun Sate Nigeria. It was where most of the insects are predominantly found due to the agrarian nature of the location.120 (36 males and 84 females) teachers were selected at 2022 teacher's day celebration, which provided good access to teachers' knowledge. Through cluster sampling technique, two clusters of teachers from river-Rhine areas and other places were used since all the schools were represented at teacher's day ceremony. The researchers' self-developed instrument included a checklist of 24 familiar stinging/biting insects and those capable of causing allergy and anaphylaxis to enable participants to recognize them. They could also find out if they can identify those that can cause allergies/ anaphylaxis among them. The 24 items of the checklist were adapted from the American Academy of Pediatric list of insects and other researchers list of biting insects. Knowledge of insect stings prevention questionnaire (KISPQ r=8.27) and knowledge of insect stings first aid treatment questionnaire (KISFATQ, r = 7.68) contained 11 question items adapted from previous studies were the instruments used to collect data. Frequency count, percentage with mean and standard deviation were measured to determine the knowledge level on types of insects and their ability to cause allergy. These instruments were content validated with the assistance of researchers in the field of education and the entomology unit of the department of animal science at Olabisi Onabanjo University Ago-iwoye Nigeria. Descriptive statistics of mean and standard deviation were used to answer the questions asked in the study, while linear regression analysis was used to test the two postulated hypotheses at 0.05 level of significance. The research participants were adequately informed of the purpose of the study and were at liberty to participate or not. They were reassured of the anonymity of their responses to the instrument as the instrument had nothing in the content which links to individual participant regarding ethical considerations. Moreover, the ethical code of the study was provided by the Ethics Committee of Olabisi Onabanjo University: OOU/SSMTHU/EC/0001/ 140223.

Results

Demographic characteristics of the study participants (N= 120)

The demographic characteristics of primary school teachers in Ogun Waterside local government area of Ogun state as shown in Table 1.

[DOR: 20.1001.1.27832104.2023.7.1.6.4]
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Table 1. Showing the demographic characteristics of respondents (N= 120)

Demographic details	Frequency (F)	Percentage (%)
Gender		
Male	48	40.0
Female	72	60.0
Work experience		
11-20	64	53.3
21-30	56	46.7
Age group		
30-39	8	6.7
40-49	88	73.3
50 years and above	24	20.0
Religion		
Muslim	60	50.0
Christian	60	50.0

Recognizing stinging/biting insects with allergic and anaphylactic reactions

Descriptive statistics indicated primary school teachers' knowledge of stinging/biting insects as shown in Table2. Overall, the teachers can recognize a good number of the stinging/biting insects (average mean of 2.52 > criteria mean of 2.50). Based on the overall average mean of 2.38 compared to the criteria mean of 2.50, teachers were not knowledgeable regarding prevention of insects' bites/stings and allergic /anaphylactic reactions.

Knowledge about first aid treatments in case of insect stings/bites' allergy/anaphylaxis

Descriptive statistics indicated teachers' knowledge of first aid treatments in cases of insect stings/bites and allergy/anaphylaxis. Based on the overall average mean of 2.68 compared to the criteria mean of 2.50, the teachers were significantly knowledgeable about first aid treatments in cases of insect stings/bites and allergic/anaphylactic reactions, Table 2

Table 2. Descriptive statistics showing teachers' knowledge of stinging and biting insects

Allergic forming insect	N	Mean	Std. Deviation	Remarks
1. Mosquito	120	3.33	1.02	Known
2. Bees	120	3.17	1.10	Known
3. Tsetse fly	120	3.17	1.13	Known
4. Ants	120	3.10	1.05	Known
5. Ants/termites	120	3.07	1.13	Known
6. Black flies	120	2.93	1.10	Known
7. Flies	120	2.93	1.13	Known
8. Emperor scorpions	120	2.90	1.17	Known
9. Spiders	120	2.83	1.16	Known
10. Dragon flies	120	2.80	1.33	Known
11. Bedbugs	120	2.67	1.28	Known
12. Moth flies	120	2.63	1.41	Known
13. Bullet ants	120	2.43	1.26	Not known
14. Fleas	120	2.33	1.28	Not known
15. Driver ants	120	2.23	1.29	Not known
16. African black beetles	120	2.23	1.26	Not known
17. Moths	120	2.20	1.28	Not known
18. Sun beetles	120	2.20	1.23	Not known
19. Tarantuls hawk wasps	120	2.17	1.22	Not known
20. Fire flies	120	2.13	1.26	Not known

Table 2. Descriptive statistics showing teachers' knowledge of stinging and biting insects

Allergic forming insect	N	Mean	Std. Deviation	Remarks
21. Earwig	120	2.10	1.14	Not known
22. Damsel flies	120	2.10	1.14	Not known
23. Wasps	120	1.90	1.23	Not known
24. Bald-faced hornets	120	1.80	0.95	Not known

Criteria mean = 2.50; Average mean = 2.52

Influence of the teachers' knowledge of allergic/anaphylactic reaction on prevention of stings/bites

Results indicated that teachers knowledge of the causes of allergy due to insect bite as shown in table3 is a potent contributor to their knowledge of prevention of anaphylaxis ($\beta = 1.375$; $t = 9.042$; $p < .05$). Nevertheless, the result of F-value of 81.760 whose probability was close to zero percent showed that teachers' knowledge had a significant influence on prevention of anaphylaxis. Hence, the null hypothesis was rejected. Teachers' knowledge of causes of allergy had a significant influence on prevention of anaphylaxis, Table 3.

Table 3. Descriptive statistics for teachers' knowledge of prevention and first aid treatment of allergies caused by insect stings/bites

Statement on prevention	N	Mean	Std. Deviation
Avoiding food preparation outside	120	2.50	1.34
Avoiding eating outdoors	120	2.57	1.31
Avoiding flowering plants	120	2.03	1.11
Avoiding drinking from straws and cans	120	2.03	1.23
Avoiding drinking from bottles outdoors	120	2.07	1.27
Avoiding removing fallen fruits	120	2.37	1.26
Avoiding pet poop	120	2.67	1.05
Covering trash cans	120	2.60	1.18
Watching for nests in bushes	120	2.47	1.26
Avoiding going out barefoot	120	2.66	1.14
Watching the ground when mowing	120	2.30	1.10

Criteria mean = 2.50; Average mean = 2.38

Statement on first aid treatment	N	Mean	Std. Deviation
Reassuring the child	120	2.20	1.20
Reassuring parents	120	2.23	1.18
Using anti-inflammatory cream	120	3.27	0.93
Applying ice cube	120	2.67	1.25
Direct pressure to the bitten spot	120	2.93	1.21
Using anti-histamin like piriton	120	2.80	1.23

Criteria mean = 2.50 Average mean = 2.68

Influence of the teacher's knowledge on first aid skills

Teachers' knowledge of the causes of allergy is a potent contributor to their knowledge of first aid treatment as shown in Table 4 ($\beta = 2.984$; $t = 10.518$; $P < .05$).

[DOR: 20.1001.1.27832104.2023.7.1.6.4]
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Table 4. Coefficients of the linear regression analysis for relative contributions of teachers' knowledge

Coefficients[a]						
		Unstandardized coefficients		Standardized coefficients		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	21.216	4.165		5.094	.000
	Knowledge on causes of allergic and anaphylactic reactions	1.375	.152	.640	9.042	.000

$R = 0.640$, $R^2 = 0.409$; $F = 81.760$ $P < 0.05$
a. Dependent variable: Knowledge of prevention of insect stings/bites

Nevertheless, the result of F-value of 110.618 whose probability was close to zero percent suggested that teachers' knowledge had a significant influence on first aid skills. Hence, the null hypothesis was rejected. Teacher's knowledge had a significant effect on first aid treatment skills, Table 5

Table 5. Coefficients of the linear regression analysis regarding teachers' knowledge of causes of allergy on first aid skills

Coefficients[a]						
		Unstandardized coefficients		Standardized coefficients		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	9.286	4.699		1.976	.050
	Knowledge on causes of allergic and anaphylactic reactions	2.984	.284	.696	10.518	.000

$R = 0.696$, $R^2 = 0.484$; $F = 110.618$ $P < 0.05$
a. Dependent variable: knowledge of first aid skills

Discussion

Primary school teachers in Ogunwaterside Nigeria (60% females and 40% male), with a minimum of 11 years of work experience and age of 30 and above,

Could significantly recognize stinging and biting insects. This is because of the 24 insects listed; a great percentage of them could recognize twelve of them. Twelve of them, however, could not be recognized by a high percentage of them. It was revealed through demographic characteristics of gender that female teachers were more knowledgeable (awareness level of 60%) compared with male teachers. On the list of the insects, teachers had poor knowledge regarding stings and their ability to cause allergy and anaphylaxis (55% males and 45% females). This was not in line with the findings by Demirkale et al in 2020.It was among bee keepers, over 80% of whom had good knowledge of allergic reactions (Demirkale, Yucel, Cimen, Suleyman, Ozdemir, Kara and Tamay, 2020) This might be due to poor understanding of the term allergy and anaphylaxis, which was duly explained for improved understanding. The result revealed that only 8 cases had a mean of above 2.5 while 16 recorded a mean of less than 2.5. Teachers need to be further educated with regard to the understanding of allergy/anaphylaxis caused by insect stings/bites. This implied that there was a need for more knowledge on the consequences of insect bites as supported in the report of study conducted by David, and Golden et al, (2017) which revealed that on the prevention of stings/bites, teachers had no adequate knowledge on how to prevent insect stings, which requires serious attention to prevent allergies/anaphylaxis caused by bites. This was in agreement with the study by Barish, and Arnold, 2022, Power and McDowell, 2022. It reported the need for patient education on signs and symptoms

[DOR: 20.1001.1.27832104.2023.7.1.6.4]
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of insect bites and stings. The results support the findings by American Academy of Pediatrics (2011) which presented several strategies to prevent insect stings including wearing long pants. Moreover, the US Department of Labor reported the need to educate on insect stings for prevention of fatality (US Department of Labor, 2021). The results supported the finding of American Academy of Pediatrics (2011) which presented several strategies that helps to prevent insect stings such as wearing of long pants.

Good knowledge of causes significantly contributes to the knowledge of prevention of allergies and anaphylaxis. This result was not in line with the one by Billo, Martini, Pravettoni, Bignardi, and Bonadonni et al (2019) work which reported inadequate knowledge of treatment due to insect stings allergy. The finding was in line with Fukutomi and Kawakami's research (2021). They confirmed that insects cause respiratory allergies which require knowledge to eradicate them. Insects have been identified to cause series of allergies especially respiratory conditions which can be prevented through knowledge of preventive methods (Dhami, Panesar, Roberts, et al 2014, Raj, Lodha, Pandey, Mukherjee and Agrawal, 2013).

The result of the findings on the knowledge of teachers in giving first aid treatment in cases of allergies revealed that the teachers are significantly knowledgeable on how to treat allergic reaction. On the effect of knowledge of stinging/biting insects on allergy revealed that teachers' knowledge of insect has significant effect on their knowledge of allergic causing insects. The result agrees with the position of (Rompis, Willar, Rondonuwa, Halim, 2022., College of Food, Agricultural and Natural Resource Sciences (CFANS) 2022., Guillet, Jeorg, Schmid, et al, 2022) the institution reported that Bed Bugs should be prevented in school through the provision of adequate knowledge to the teachers and that bed bugs are causing allergies (Sheele, 2021). It is then noted that if the teachers are knowledgeable about general insects' characteristics, they will be significantly aware of those causing allergies and anaphylaxis.

The study revealed that significant knowledge of causes of insect stings/bites would significantly contribute to teacher's knowledge of first aid skills in cases of allergies and anaphylaxis (National Institute for Health and Care Excellence, 2020). This study may be limited by the mood of the participants sampled during the Teachers' Day celebration. They may not have had adequate concentration in their responses to all the question items on the instrument. The research might also have been limited by understanding of English names and local description of some of the biting and stinging insects.

Conclusion

The study was carried out to determine teachers' knowledge of allergies and anaphylaxis regarding insect stings and bites. Teachers' significant knowledge of causes of insect stings/bites will significantly contribute to their knowledge of first aid skills in cases of allergies and anaphylaxis.

The results revealed that teachers are significantly knowledgeable about some of the existing stinging and biting insects. However, they do not know enough about some of the allergies caused by the bites or stings from some of the insects. Additionally, the knowledge of allergic reaction regarding insect bites is important to the knowledge of prevention of stings and bites and also the knowledge of first aid skills in cases of insect's stings and bites. Therefore, it is imperative that a course regarding allergies prevention of insect bite and stings be added to the primary school health education curriculum for better understanding of both the teachers and pupils. On the other hand, teachers should also be trained on prevention and treatment of allergic reaction in schools.

Acknowledgement

The authors would like to thank Nigeria Union of Teachers (NUT) Ogun State branch, particularly Mr. Ibrahim (the Chairman of NUT Ogunwaterside local government), who approved and allowed the administration of instrument during 2022 teachers'

day celebration at the teachers' house Abigi.

Conflict of interest

The authors declared no conflict of interest.

Authors' contribution

Conceptualization, design and construction of the instrument were carried out by S. A. O.; proof-reading, data set and analysis by V. O. A.; and administration of instrument and typesetting was conducted by R. A. A. The manuscript was reviewed and approved by all the authors.

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