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***Full Length Research Paper***

# Myiasis and its risk factors among children in parts of Enugu Nigeria

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## ABSTRACT

Myiasis is invasion of vertebrate tissues by larvae of dipterous flies. The environment of sub-Saharan Africa is favourable for the development myiasis flies. A health center-based cross-sectional study of myiasis and its risk factors among children in parts of Enugu, Nigeria was done between August and October 2019. Ethics and Research Committee Approval with reference number ESUTHP/C–MAC/RA/034/VOL.I/210 from Enugu State University Teaching Hospital was used for the study while informed consent was granted by parents of participants. Sample size of 102 was selected from registered 137 children presented at primary health centers during the study period. Arms, knees, thighs, and buttocks of children were examined for boil-like lesions, suggestive of myiasis infections. Cholesterol-free laser oil was applied to the lesions to allow for easy exit of larva for want of oxygen. Recovered larvae were killed by immersion for thirty seconds in hot water, and preserved in 70% ethanol solution. Length and width of larvae were subsequently measured in millimeters while entire surfaces were examined with hand lens for characteristic identification features specific for myiasis larvae. Data generated on location, gender, and age prevalence of infection and its associated risks were analyzed in MS Excel version 2013, using Bar Charts with Standard Error Bars indicating significant differences ($p<0.05$) between variables. Widths and lengths of recovered larvae measured between 4–5 mm and 12–15mmrespectively, and their anterior ends showed two characteristic black mouth-hooks characteristic of larvae of *Cordylobia anthropophaga*. Overall prevalence of myiasis was 5.9%, with highest prevalence (8.9%) recorded at Emene Health center, followed by Onuogba Health Centre (7.1%) and Akpuoga Health Centre (6.7%). There was no apparent infection in children presented at four other Health Centers. Generally, there was higher prevalence in boys (8.8%) than girls (3.5%). Also, highest prevalence in age-group of 13-20 years(14.3%) was followed by age-group of 7-12 years (8.1%) while those six years and below were not apparently infected. Thighs, buttocks and knees respectively accounted for about 50, 33.3, and 16.7% of recovered larvae. Children in peri-urban areas had higher prevalence (6.3%) than those in rural areas (5.1%). Open defecation, spreading clothing on ground, use of non-disposable infant diapers, and urine-wetted beddings were among observed risks for myiasis. It is therefore important that parents be made aware of myiasis and its risk factors to avoid outbreaks in the study area.

**Keywords:** Myiasis, *Cordylobia anthropophaga*, risk factors, awareness, Enugu-Nigeria

## INTRODUCTION

The term myiasis was coined by Hope (1840), and it denotes the invasion of vertebrate tissues by dipterous larvae (Jose *et al*., 2010).Myiasis could be obligatory or facultative (Imtiaz *et al.*, 2014). In obligatory myiasis, the larvae complete their development in living tissue while in facultative, development could be in either living or dead tissues (Jelinek *et al.*, 1995). Depending on the anatomical site of

larvae, myiasis could also be described as cuticole, cavicole, gastricole, anal, genito-urinary, nasopharyngeal, and ocular (Dik *et al.,* 2012). Terms like traumatic, furuncular, creeping and sanguinous may also be used to refer to myiasis associated with open-wounds, boils, sub-cutis, and blood-sucking, respectively (Dada *et al.*, 2005).

Larvae of flies in the family of Calliphoridae, Sarcophagidae, Hypodermatidae, Oestridae (Ikpeze, 2009) and Gasterophilidae are responsible for majority of Myiasis in animals and humans but rare cases have been reported with species in the families of Muscidae, and Psychodidae (Imtiaz *et al.,* 2014). *Cordylobia anthropophaga* commonly known as "African tumbu fly", "mango fly" is the common Myiasis fly in sub-Sahara Africa (Tamir *et al.,* 2003). *Cordylobia anthropophaga* has many names in Nigeria; it is called "Tsutsan-pata" in Hausas, "Nyet" or "Bililir" by Mangusof Plateau, "Ukpokho-egbe or Idu" by Igueben (Esan) of Edo State, "Ide-Ola" by Igalas, and "Oti ime aru" by Igbos (Ojemudia *et al.,* 2010).

Life cycle in myiasis fly varies but generally, female fly lays eggs directly on the host, either in viable or necrotic tissue or tissue that has previously been infested with screw worms (Angulo-valadez *et al.,* 2010), or in wet conditions associated with urine and fecal contaminations (Imtiaz *et al.,* 2014).Two to four days after oviposition, egg hatches into larva which penetrates available host and moults twice between 12-15days when the 3$^{rd}$ instar larva exits the host, pupates within 12-48 hours, and adult emerges in 23-26 days to feed, mate and lay eggs for the next life cycle (Anna,2001).

To effectively prevent the invasion of flies into premises, good sanitation and effective proofing measures are very important. Control of myiasis therefore largely depends on prevention of contact between myiasis flies and non-infested animals and stopping the production cycle of myiasis flies by appropriate treatment of the infested animals (Baumhover, 2002).Drying clothes in bright sunlight and ironing them are also effective methods of destroying occult eggs laid in clothing, especially by *C. anthropophaga* (Fabio *et al.,* 2012).

In children, the condition of myiasis could lead to severe irritation, disruption of feeding, growth retardation, unthriftiness, weight loss, and secondary bacterial infections (Hall *et al.,* 1995). The present study was focused on myiasis and its associated risk factors among children in selected communities in Enugu East Local Government Area (ELGA) of Enugu State, south-eastern Nigeria. The findings will help in evidence-based policy decision to control myiasis in the study area.

## MATERIALS AND METHODS

**Study area:** The study was carried out in Enugu ELGA of Enugu State (6° 27′ 9.60"N; 7°30′ 37.20"E), south-eastern Nigeria (Figure 1). The area lies within the tropical rainforest zone, with patches of derived savannah. The climate is warm and humid with average daily temperature of 26.7°C, and with alternations of the wet and dry seasons. The LGA has both urban and peri-urban settlements with a population of about 279,089(NPC 2006) comprising civil servants, traders, subsistence farmers and artisans and school children. Primary health centers and veterinary clinics are among the health facilities in the study area. There are also livestock markets, slaughter slabs, small abattoirs and butchers' stalls at several locations in Enugu East LGA. The environment of these facilities is generally favourable for the development and maintenance of non-biting flies of medical and veterinary importance (Ozumba *et al*., 2014; Ikpeze *et al*., 2008).

**Study design:** A cross-sectional health center-based study was carried out between August and October 2019 with

the cooperation of staff of seven health centers studied in the area. Parents or guardians of the examined children were interviewed orally for information on socio-demographics, living conditions and hygiene habits of the parents and their children.

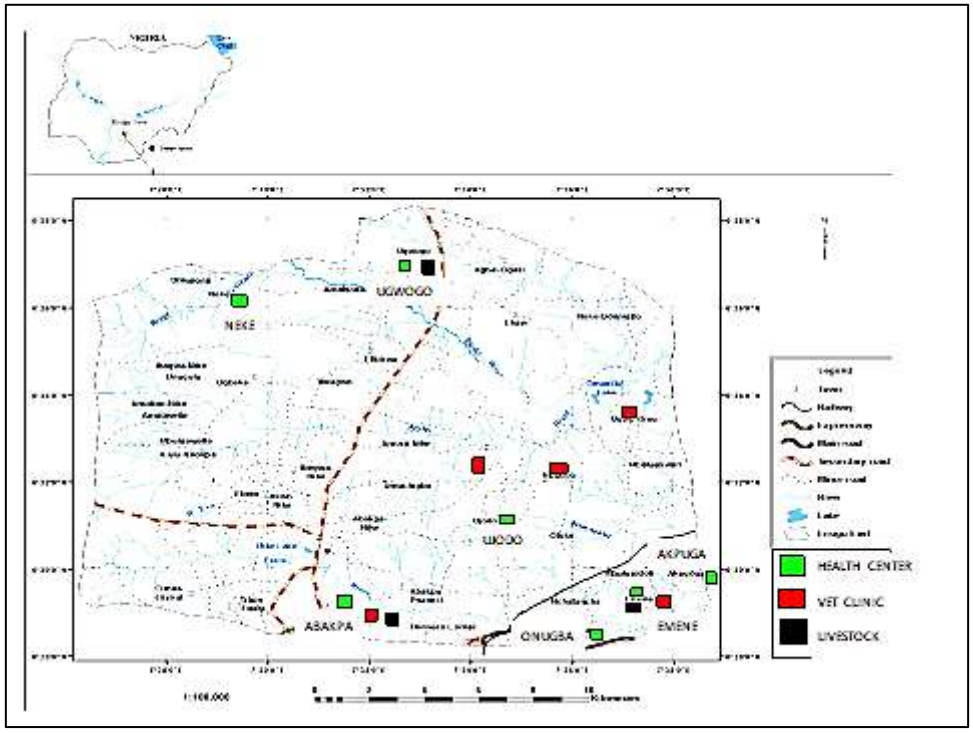


**Figure 1:** Enugu East Local Government Area (Nigeria inset) showing locations of seven Primary Health Centers studied.

**Ethical considerations:** Ethical approval for the study was obtained from Ethics and Research Committee of Enugu State University Teaching Hospital, Enugu with Reference Number: ESUTHP/C – MAC/RA/034/VOL.I/210). Permission to conduct the research in the primary health centers in area was also granted by the Enugu East LGA Head of Health Department. Informed oral-consent of parents and guardians of the children that participated in the study were obtained after the importance of the study was clearly explained to them by the researchers and staff of the Primary Health Centers.

**Study population:** The study population comprised all under 20 years-old children(n=137)presented at the health centers visited at Abakpa, Akpuga, Emene, Neke, Onugba, Ugwogo, and Ujodo communities during the study period.

**Sample size:** The sample size of 102 children was determined using the minimum sample-size formula,

$n = \frac{N}{1+N(e^2)}$, where $n$ is minimum sample size, $N$ is study population, $e$ is error term, 0.05 at 95% confidence interval (Rao and Scott, 1992). Then, $n = \frac{137}{1+(137\ x\ 0.05^2)}$

$$n = \frac{137}{1+o.3425} = \frac{137}{1.3425} = 102.048.$$

One hundred and two (102) children were therefore considered suitable for the study. This number was systematically selected from the attendance register kept at the primary health centers during the study period.

**Examination of children for Myiasis:** The exposed areas of the body of the children, like forearms, knees, thighs, and buttocks, were systematically examined, with the help of the health center medical personnel, for boil-like lesions. Larvae

from suspected areas surfaces of the examined children were mechanically extruded by pressure after application of cholesterol free oil (Laser oil)to reduce oxygen supply to larvae for them so wriggle out for want of air (Ramana, 2012). Follow-up treatment of wounds on the affected children was carried out by staff of the health centers concerned.

**Preservation and identification of recovered myiasis larvae:** After removal, the larvae were killed by immersion for 30secs in very hot water and to maintain the natural colour, and latter preserved in a solution of 70% ethanol. The lengths and width of larvae were measured in millimeters, and the entire surface viewed thoroughly with hand lens to observe characteristic morphological identification features such as shape, nature of cuticular spines, and nature of labial sclerites comparable with those described by Akpan (2016) and Gordon *et al.*(1962).

**Data analysis:** Data generated on location, gender, and age prevalence of infection and its associated risks were analyzed in MS Excel version 2013, using Bar Charts with Standard Error Bars indicating significant differences ($p<0.05$) between variables.

## RESULTS AND DISCUSSIONS

Myiasis larvae recovered from infected infants were identified as those of myiasis fly *Cordylobia anthropophaga*. Their width ranged between 4 and 5 mm while the lengths ranged between 12 and 15mm but these sizes depended on the developmental stages of larval instars at time of recovery. The anterior ends of the larvae clearly showed two black mouth-hooks characteristic of larvae of *C. anthropophaga* (Plate 1).

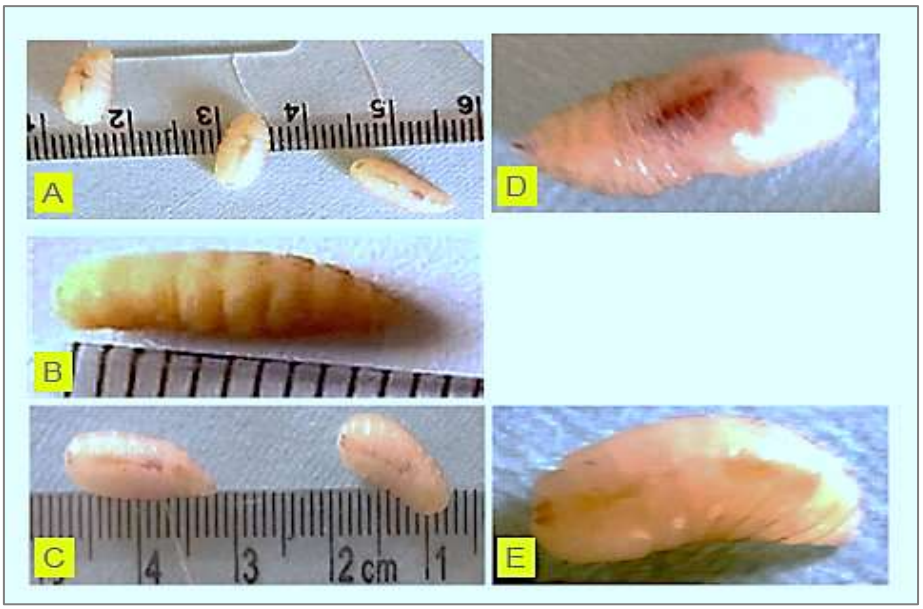


**Plate 1:** Identified live larvae of myiasis fly *Cordylobia anthropophaga*, measured 4 to 5 mm in width [A], and 12 to 15mm in length [B and C]. The anterior ends [C, D and E] also showed two black mouth-hooks characteristic of *C. anthropophaga* larvae.

In related studies in parts of Nigeria, *C. anthropophaga* were recovered from infants in Niger Delta wetlands and children in Enugu state (Ogbalu *et al.*, 2011), and from dogs in Jos (Ogo *et al.*, 2009) while larvae of *Oestrus ovis* were seen at autopsy in West African Dwarf (WAD) sheep at Umudike (Ikpeze, 2009). These findings indicated that larvae of *C. anthropophaga* could infect both man and his domestic pets. In Rio de Janeiro, however, furuncular and cavitary myiasis

were reported to be caused by the New World human botfly *Dermatobia hominis* and an indigenous species of New World screwworm *Cochliomyia macellaria*, respectively (Marquez *et al.*, 2007).

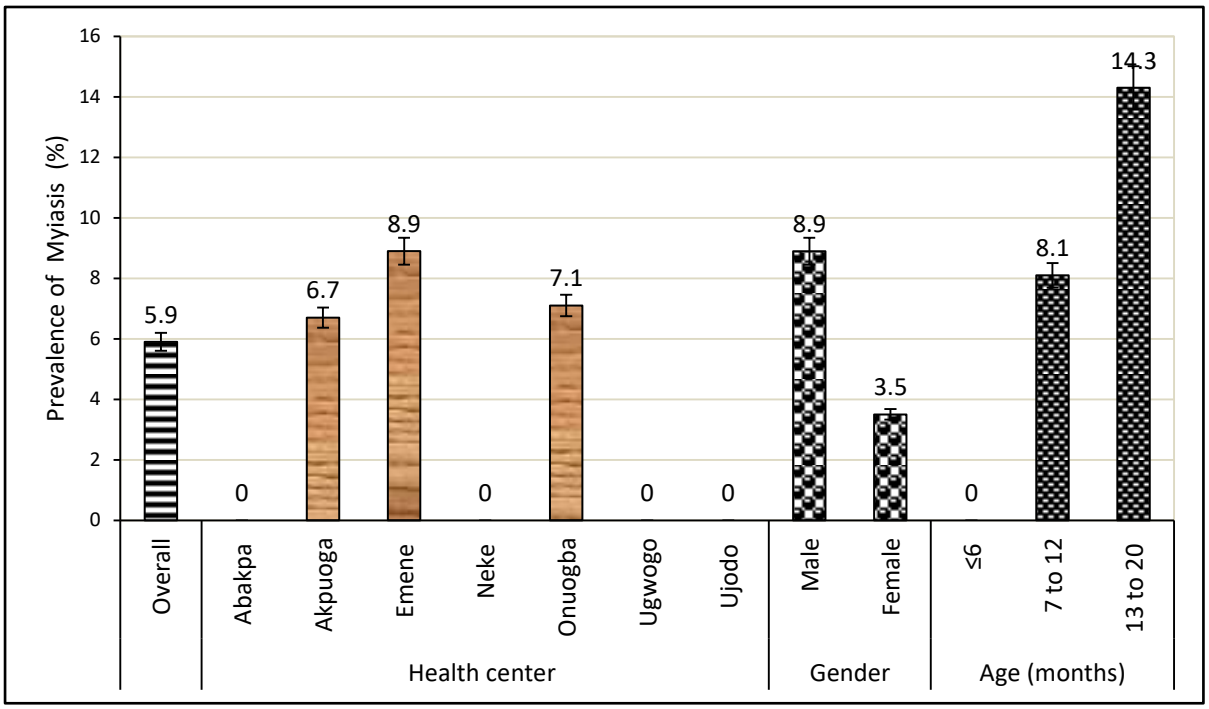


**Figure 2:** Overall prevalence of Myiasis infection due to larvae of *Cordylobia anthropophaga* among children examined at seven health Centers. Standard Error Bars indicated significant differences ($P$<0.5) in prevalence between the variables studied.

The overall prevalence of Myiasis due to *C. anthropophaga* larvae among the children examined was 5.9% (Figure 2). The highest infection rate of 8.9% was recorded at Emene Health center, followed by Onuogba Health Centre with 7.1%while Akpuoga Health Centre recorded 6.7%. Children examined at Abakpa, Neke, Ugwogo, and Ujodo Health Centers had no infection. Boys had higher infection rate of 8.8% than girls with 3.5%, perhaps due to the fact that boys become more adventurist than girls as well as their increased activeness in playing with sand. Also the highest infection rate of 14.3% was recorded among the age group of 13-20 years, followed by the age-group of 7-12 years with 8.1% while those six years and under were apparently not infected. This overall infection rate differed from an earlier report of 16% in neonates and children with *C. anthropophaga* in the whole of Enugu State (Ogbalu *et al.*, 2011).

About 50, 33.3, and 16.7% of myiasis larvae in this study were recovered from the thighs, buttocks and knees respectively. Kouam *et al.* (2017) had reported that myiasis occurred at various sites of the body, such as eyes, intestines, mouth, nose, urogenital tract and brain but according Batista-da-Silva *et al.* (2011), legs and feet were commonly parasitized. Ogbalu *et al.* (2011) reported that the thighs of neonates, and buttocks in toddlers and children were the commonest predilection sites for myiasis. Infected thighs and buttocks observed in the present study was perhaps due to frequent re-use of under wears and shorts previously washed but not fully sun-dried on grasses and shrubs where myiasis flies might have laid eggs. Also, odours emanating from urine-wetted mats and other bedding materials spread to dry outside the house

might also have attracted myiasis flies for oviposition.

In Figure 3 where the overall prevalence of Myiasis was 5.9%, it was observed that the infants whose parents or guardians' educational level was secondary school recorded the highest infection prevalence of 6.5%, followed by those with primary education with 6.0% while infants whose parents attained tertiary level of education had the least prevalence of 4.8%. It has been emphasized that low educational levels represented practically all the cases of myiasis they observed (Batista-da-Silva *et al*., 2009).

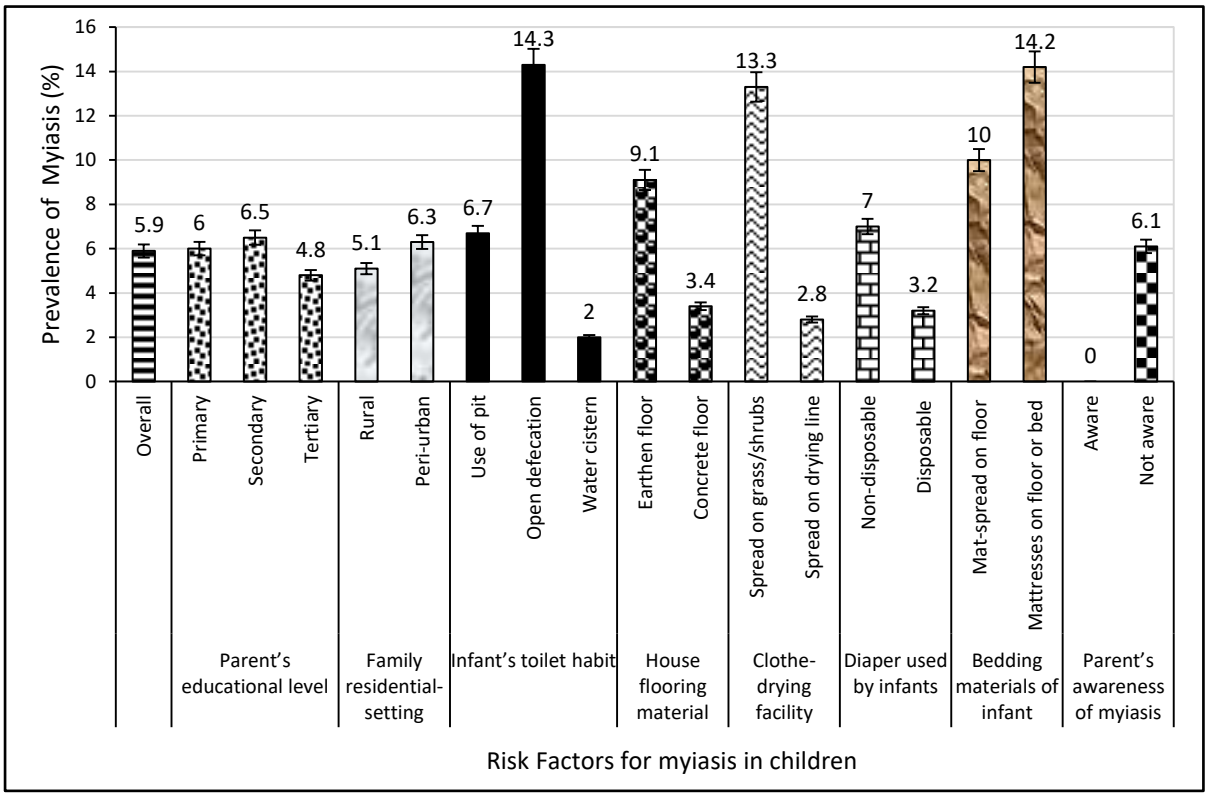


**Figure 3:** Overall prevalence of myiasis due to larvae of *C. anthropophaga* among children according to identified risk factors. Standard Error Bars indicated significant differences ($P$<0.5) in prevalence between variables studied.

Children in peri-urban areas had infection prevalence of 6.3% higher than 5.1% recorded by those in rural areas. It was suggested that higher prevalence of myiasis in peri-urban areas of Sao Gancalo, Rio de Janeiro, Brazil was due to the presence of stray animals such as dogs, cats, horses, and cattle which actively dispersed myiasis larvae in peri-urban area (Batista-da-Silva *et al.*, 2011). This situation was similar to peri-urban areas of Enugu where stray animals have been There was also significant difference (P<0.05) in myiasis prevalence between infants who live in houses with earthen floor and concrete (cemented floors), with reported to scavenge on street garbage, refuse dumps, sewage effluents, slaughter premises, markets, shallow streams, open parks, farmlands, and school premises to constitute potential hazards to public and environmental health (Ikpeze, 2005).

It was clearly shown in Figure 3 that in household where open defecation was practiced, the infection rate of 14.3% was higher than 6.7 and 2% respectively recorded in children from households with pit latrines and water closets (P<0.05). the former recording 9.1% while the later had 3.4%.

Other high risks for Myiasis observed were spreading of children's

clothing on the ground or on shrubs, frequent use of non-disposable diapers, children sleeping on urine-wetted mats and mattresses, and frequent dumping of clothes on the ground by children before playing, and to putting them on thereafter. Sherman (2000) suggested that specific habits, such as sitting or lying on bare floors, promoted the occurrence of myiasis in children while Batista-da-Silva *et al*. (2009) attributed poor hygiene as one of the major risk factors of myiasis.

Children of parents that were not aware of myiasis, in the present study had prevalence of infection (6.1%) while those with whose parents had awareness of myiasis were apparently not infected. Singh *et al.* (2015) had emphasized that ignorance plays a key role in occurrence of myiasis, and noted that people who are generally unaware of the actual cause of myiasis often associate the condition with their superstitious beliefs.

## CONCLUSION

This study has revealed that the myiasis fly *C. anthropophaga* was responsible for myiasis infections observed in the study area. Also, open defecation, spreading clothing on ground, use of non-disposable diapers, and urine-wetted beddings were important risk factors for myiasis in the study area. It is therefore important that parents, generally, be made aware of myiasis and its risk factors to avoid potential outbreak of the infection and its public health implications in Enugu East Local Government Area and elsewhere in the country.

**Competing interests:** None declared.

## REFERENCES


Akpan, S.S. (2016). A case of Cutaneous Myiasis caused by a larva of *Cordylobia anthropophaga* in a nine year old Boy in Calabar, Southern Nigeria. *American Journal of Environmental and Occupational Health*,1(1):11-14.

Angulo-Valadez, C.E. Scholl, P.J., Cepeda-Palacios, R., Jacquiet, P and Dorchies, P. (2010). Nasal bots: a fascinating world! *Veterinary Parasitology*, 174(1-2):19-25.

Anna, M.W. (2001). Infectious public health challenges program in Human Biology, Parasitology and Persistence, 103.

Batista-da-Silva, J.A., Moya-Borja, G.E and Queiroz, M.M.C.(2011).Factors of susceptibility of human myiasis caused by the New World 4,5 Screw-worm *Cochliomyia hominivorax* in Sao Gancalo, Rio de Janeiro, Brazil. *Journal of Insect Science*,11(14):1-7.

Batista-da-Silva, J.A., Abadio, H.C and Queiroz, M.M.(2009).Human Myiasis by *Dermatobia hominis* (Linnaeus Jr.)(Diptera, Cuterebridgae) and *Cochliomyia hominivorax* (Coquerel) (Diptera, Calliphoridae) in parasitic succession. *Scientific Journal of Entomologists in Brazil*, 2(2):61-63.

Baumhover, A.H. (2002). A personal account of development the sterile insect technique to eradicate the screwworm from curacao, Florida and the south eastern United States. *Florida Entomologist*, 85(4):666-673.

Curtis, S.J., Edwards, C., Athulathmuda, C and Paul, J. (2006).Case of the Month: Cutaneous myiasis in a returning traveler from the Algarve. First report of tumbu maggots, *Cordylobia anthropophaga* acquired in Portugal. *Emergency Medical Journal*,23(3):236-237.

Dada-Adegbola, H.O and Oluwatogba, O.A. (2005).Cutaneous myiasis presenting as chronic furunculosis. *West Africa Journal of Medicine*, 24(4):346-347.

Dik, B., Uslu, U and Isik, N. (2012).Myiasis in animals and human beings in Turkey. *Kafkas Universitesi Veteriner Fakultesi Dergisi*, 18(1):37-42.

Fabio, F and Omar, L. (2012) Myiasis. *Clinical Microbiology Reviews*, 25(1):79-105.

Gordon, R.M and Lavoipierre, M.M.J. (1962). The family Calliphoridae In: Entomology for students of

Medicine. 5th edition.Blackwell Scientific Publications. London. Pp.189-198.

Hall, M.J and Wall, R. (1995).Myiasis of humans and domestic animals. *Advances in Parasitology*, 35:257-334.

Hope, F.W. (1840). On Insects and their larvae occasionally found in the human body. *Transactions of the Royal Entomological Society of London*, 1840:256-271.

Ikpeze, O.O. (2009). Diagnosis of nasal myiasis in the West African Dwarf (WAD) sheep in Umudike Abia State, south-eastern Nigeria. *Animal Research International*, 6(1):938-941.

Ikpeze, O.O (2005). Stratification and livestock population census for Enugu Urban, Nigeria: A pilot survey. *Animal Research International*, 2(2):332-335.

Ikpeze, O.O., Ozumba, N.A., Eneanya, C.I and Onyido, A.E. (2008). Urban Fly Control Studies in Nigeria: Comparative diversity indices of non-biting flies in different market meat stalls at Enugu Nigeria. *Journal of Medical and Pharmaceutical Sciences*, 4(2):41-46.

Imtiaz, M.A., Rahman, A.M., Islam, K., Barua, M., Alim, A.M., Chowdhury, S and Sikder, S. (2014). Prevalence and associated risk factors of myiasis in different areas of Chittagong, Bangladesh. *Research Journal for Veterinary Practitioners*, 2(2):22-27.

Jelinek, T., Nothdurft, H., Reider, N and Loscher, T. (1995). Cutaneous Myiasis: review of 13 cases of travelers returning from tropical countries. *International Journal of Dermatology*, 34(9):624-626.

Jose, G.B.D., Allen, C.G.A and Marius, R. (2010). Human Myiasis in New Zealand: Imported and indigenously-acquired cases; the species of concern and clinical aspects. *The New Zealand Medical Journal*, 123(1322):21-38.

Kouam, M.K., Meutchieye, F., Miegoue, T. Nguafack, T., Tchoumboue, J and Teguia, A. (2017). Prevalence and husbandry related risk factors of myiasis in domestic cavies in the western highlands of Cameroon. *Epidemiology of Infection*, 145:339-346.

Marquez, A.T., Mattos, M.D.A and Nascimento, S.B. (2007). Myiasis associate with some socio-economic factor in five urban areas of the State of Rio de Janeiro. *Journal of the Brazilian Society of Tropical Medicine*, 40(2):175-180.

NPC (2006).National Population Commission, Nigerian population census report 2006.

Ogbalu, O.K., Achufusi, T.G., Orlu, E.E., Bawo, D.S., Adibe, H.C., Kumbe, L., Aguonwu, O and Amadi, E. (2011).Human myiasis in neonates and children of Niger Delta Wetlands and South East Nigeria. *Journal of Cosmetics, Dermatological Sciences and Application*, 1:171-176.

Ogo, N.I.E., Onovoh, D.R., Ayodele, O.O., Ajayi, C.O., Chukwu, M. and Sugun, I.O. (2009).Cutaneous canine myiasis in Jos metropolis of Plateau State, Nigeria, associated with *Cordylobia anthropophaga*. *Veterinarski Archive*, 79(3):293-299.

Ojemudia, T.I., Olabode, A.O., Okeke, O.I., Chukwu C.O.O., Duru, B.N., Adeyanju, O.N., Ashi, R.I. Nedosa, A.U and Dogo, G.I.A. (2010).Emergence of Zoonotic myiasis in Vom and Bukuru Metropolis, Jos South LGA, Plateau State, Nigeria. *Global Journal of Health Science*, 3(1):104-109.

Olea, M.S., Centeno, N., Aybar, C.A.V., Ortega, E.S., Galante, G.B., Olea, L and Juri, M.J.D. (2014).First report of Myiasis caused by *Cochliomyia homini vorax* (Diptera: Calliphoridae) in a diabetic foot ulcer patient in Argentina. *Korean Journal of Parasitology*. 52(1):89-92.

Ozumba, N.A., Ikpeze, O.O., Onyido, A.E., Ezike, V.I and Ngenegbo, U.C.(2014).Flies of veterinary and public health importance in meat stalls at Enugu, Nigeria. *International*

*Journal of Veterinary Science*, 3(2):91-94.

Rao, J.N and Scott, A.J. (1992).A Simple Method for the Analysis of Clustered Binary Data, *Biometrics*,48:577-585.

Sherman, R.A. (2000). Wound myiasis in urban and suburban United States. *Archive of Internal Medicine*, 160(13):2004-2014.

Singh, A and Singh, Z. (2015).Incidence of myiasis among humans- A review. *Parasitology Resource*,114(9):3183-3199.

Tamir, J., Hark, J and Schwartz, E. (2003). Myiasis with Lund's fly in travelers. *Journal of Travel Medicine*, 10(5):293-295.