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RESEARCH ARTICLE

Flies of Veterinary and Public Health Importance in Meat Stalls at Enugu, Nigeria

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ABSTRACT

Raw meat and other food products displayed for sale in meat stalls in Nigeria usually attract non-biting flies known to transmit pathogens of veterinary and public health importance. Presence of non-biting flies in meat stalls at Artisan, Gariki, and New Haven Markets in Enugu, south-eastern Nigeria were recorded for 8 months in 2012. A total of 102648 non-biting flies were collected from the three markets' meat stalls by making 2400 sweep nets; giving an average of 42.8 flies per sweep net. The number of flies collected from Artisan market was 46555 (45.45%), Gariki 40883 (39.83%) and New Haven 15210 (14.82%). There was significant difference ($P<0.05$) between the number of species of flies identified which included *Musca domestica* [97387 (94.87%)], *Chrysomya putoria* [4346 (4.24%)], *Calliphora* spp. [639 (0.62%)], *Fannia canicularis* [173 (0.17%)], and *Fannia scalaris* [103 (0.10%)]. More flies were observed in the evenings [48748 (47.49%)] than mornings [34216 (33.33%)] and afternoons [19684 (19.18%)]. However, these numbers increased gradually during the dry season but diminished rapidly in the rainy season Efforts should be made to greatly reduce their numbers in order to prevent contamination of meat and other food products sold for human consumption in the markets. Veterinary and Medical personnel should carry out bacteriological and parasitological tests on samples of meat displayed in open meat stalls as part of routine meat inspection for preventive diagnosis of potential pathogenic organisms that are carried on the bodies of non-biting flies that perch on meat.

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INTRODUCTION

Non-biting species of flies encountered in open market meat stalls in Nigeria play a great role in the mechanical transmission of enteric and parasitic diseases and therefore constitute a lot of health hazard to man (Nwangwu *et al*., 2013). Mechanical transmission of pathogen from one location to another is facilitated by adult flies' habit of walking and feeding on materials that tend to be contaminated, then doing the same on food and meat to be consumed by man. Secretion of crop contents as well as defecating while feeding also enhances the risk of pathogen transmission by flies (AFPMB, 2011). The list of diseases known to be transmitted by the domestic fly alone is inexhaustive, but most are enteric diseases resulting from faecal contamination, such as cholera, shigellosis, typhoid fever, hepatitis, salmonellas and numerous dysenteries. In one study, it was reported that 70% of the flies from a goat yard contained coccidian oocyst in their gut (Dipeolu and Kahn, 1991). Besides, the house fly which perched on anthrax and tuberculosis-infected carcasses could mechanically transmit the infections directly to man and through contamination of other carcasses in the meat stall. The blow flies (*Calliphora* spp.) most of which help in the decomposition of carcasses have been reported to cause pseudo Myiasis, whereby their maggots infect the skin of man and animals, while the maggots of *Chrysomya* spp. are reported to be facultative parasites of man and animals (Nwangwu *et al*., 2013). Moreover, economic and public health significance of these flies has been documented (McLeod, 1999).

Dearth of information on infestation of meat by flies in market meat stalls in Nigeria stimulated this study which aimed to identify the presence, species and population of non-biting flies as well as conditions that favour their breeding in market meat stalls at Enugu. The results will sensitize the public on the dangers posed by

these non-biting flies, so that efforts should be geared towards greatly reducing their numbers to prevent their contamination of foods meant for human consumption.

MATERIALS AND METHODS

Three markets' meat stalls namely, Gariki, Artisan and New Haven Markets meat stalls in Enugu, south-eastern Nigeria were sampled for 8 months in 2012 for species of non-biting flies, using sweep-net sampling technique. Collections using sweep-nets were made simultaneously in the mornings (7.00a.m-12.00noon), afternoons (12.00noon-4.00p.m) and evenings (4.00p.m-7.00p.m) in all the market meat stalls studied by three teams. Each team of four was led by a research Entomologist or Parasitologist, supported by three Entomological Technicians. Collections could only be done for 8 months of that year due to constraints beyond the control of the researchers. All the flies collected were sorted, preserved and identified in the Entomological Laboratory of the National Arbovirus and Vector Research Centre (NAVRC) Enugu, using typical morphological features and identification keys (APMB, 2011).

RESULTS AND DISCUSSION

Table 1 showed the total population of flies collected from the 3 markets' meat stalls studied for 8 months in 2012. Table 1 also revealed that Artisan market had the highest population of flies collected, followed by Gariki, with New Haven being the least.

The number and population of species of flies encountered in the whole collections were shown in Table 2, where *M. domestica* demonstrated a very high predominance over the other species, which followed in the order *Ch. putoria*, *Calliphora species*, *F. canicularis*, and *F. scalaris*. Since a total number of 2400 sweep-nets were made for all the collections, the population density of the flies was estimated at 42.8 (i.e., 102648/2400 flies per sweep-net).

Table 3 clearly revealed the predominance of *M. domestica* over the other species from the respective meat stalls for the 8 months of collection.

Table 4 showed the collections of flies from the 3 meat stalls in Enugu at different times of the day for each of the 8 months covered by the study. It was observed that these flies most highly infested the meat stalls in the evenings but were very scanty in the afternoons.

Generally, the number of flies collected in 8 months from the three markets under survey was quite enormous, numbering about a hundred thousand. It must be mentioned that collections were made for 8 months due to financial and transport constraints encountered during the field work; and that in no small way affected the overall result since one could only imagine the number of flies that should have been collected if January, June, July and August were covered by the study. For instance, it would have been very interesting to make a good comparison between the populations of flies during the entire wet and dry seasons. Nevertheless, efforts were made here to decipher the result as much as possible. It appeared that these flies increased in population in the dry months of the year (February to April) and diminished towards the middle of the year, from May to October, during the rainy season. This phenomenon could easily be explained in that during the hot seasons there were greater chances of the food items displayed in the various stalls to perish and emit unwanted odours that attracted the flies. Moreover the high environmental temperature witnessed in the study area helped garbage observed near the meat stalls to decay; and the intensity of the sun might help in driving the flies out of their hiding places and habitats to perch and crawl over the exposed meat and other food items in the markets. It was strongly believed that flies breed more at this season due to favourable conditions that abound. On the other hand, rainy season did not afford the flies that much opportunity to fly about to perch and crawl over displayed items. Again, rains may disturb their mating procedures and even washed away both their eggs and larvae or breeding places.

Out of the 3 markets' meat stalls surveyed, Artisan demonstrated the highest concentration of these flies in the 8 months of study, except in March and April when the highest number was caught from Gariki. A number of reasons may be attributable to this. The site where these flies were being collected from Artisan market equally served for the buying and selling of other livestock especially goats and sheep; and for the slaughtering, roasting and cutting of the carcasses for sale. So this is enough to attract flies despite the fact that there was a running tap which was used for washing off the used tables. But in Gariki market, the site of collection of these flies had been moved from the previous location where the slaughter house was very close to the market. At the present site, the slaughter house is quite a distance from the market and dumping of refuse was not allowed near the market. Moreover, meat section was set apart from the rest of the market with brick and cement walls; and the tables and slabs where meat was displayed were usually washed before and after sales. The only item lacking was the wire gauze or mesh to keep flies from perching and crawling on the meat proper. The very low numbers collected from New Haven market meat stalls throughout the period was due to the fact that the market is situated in the low density area of Enugu Urban (Ikpeze, 2005.) and the majority of people it serves are averagely educated; coupled with the fact that the market is quite small and only a fraction of it serves for the meat stalls. Moreover, there is no slaughter house near the market rather the butchers procured their own share of the carcasses from other markets like Gariki and Artisan. Perhaps these suggested why New Haven market meat stalls was relatively clean, judging by the standards of the other two markets. This observation is in line with the report (Ikpeze *et al*., 2008) that diversity and dominance of non-biting for Artisan was significantly higher than that for New Haven market meat stall but was not significantly higher than that for Gariki.

The predominance of non-biting flies observed in the evenings may be attributed to the fact that by that time most of the displayed food items had started to decay; and odours emitted then attracted the flies. Also, feeding and breeding habits of the flies might have contributed to their large number coupled with the fact that the markets were fullest and dirtiest at evening time. Perhaps the intensity

Table 1: Total number of non-biting flies from meat stalls at Enugu in 2012

Meat stall	Feb.	March	April	May	Sept.	Oct.	Nov.	Dec.	Total
Gariki	8033	9172	14651	2083	3454	1191	1208	1091	40883
Artisan	10587	8240	11084	4254	5283	2398	1615	3094	46555
New Haven	2701	1850	4534	1547	910	1475	851	1342	15210
Total	21321	19262	30269	7884	9647	5064	3674	5527	102648

Table 2: Total number of individual species of non-biting flies from all meat stalls

Species	Feb.	March	April	May	Sept.	Oct.	Nov.	Dec.	Total
Musca domestica	20712	18905	29825	7440	8714	3889	2848	5054	97387
Fannia canicularis	43	63	51	2	5	7	0	2	173
Fannia scalaris	9	34	35	1	10	11	0	3	103
Calliphora sp.	98	64	84	59	74	71	116	73	639
Chrysomya putoria	459	196	274	382	844	1086	710	395	4346
Total	21321	19262	30269	7884	9647	5064	3674	5527	102648

Table 3: Total number of individual species of non-biting flies from 3 meat stalls studied

Meat stall	Species	Feb.	Mar	Apr	May	Sept.	Oct.	Nov.	Dec.	Total
Gariki	*M. domestica*	7727	9066	14469	1998	3139	941	787	982	39109
	F. canicularis	13	14	26	2	1	0	0	0	56
	F. scalaris	4	1	21	1	2	3	0	0	32
	Calliphora sp.	62	25	23	15	44	28	96	22	315
	Ch. putoria	227	66	112	67	268	219	325	87	1371
	Total	8033	9172	14651	2083	3454	1191	1208	1091	40883
Artisan	*M. domestica*	10454	8057	10928	3926	4870	1787	1347	2866	44235
	F. canicularis	20	36	15	0	4	0	0	2	77
	F. scalaris	3	25	11	0	6	0	0	3	48
	Calliphora sp.	6	26	36	19	19	22	11	27	166
	Ch. putoria	104	96	94	309	384	589	257	196	2029
	Total	10587	8240	11084	4254	5283	2398	1615	3094	46555
New Haven	*M. domestica*	2531	1782	4428	1516	705	1161	714	1206	14043
	F. canicularis	10	13	10	0	0	7	0	0	40
	F. scalaris	2	8	3	0	2	8	0	0	23
	Calliphora sp.	30	13	25	25	11	21	9	24	158
	Ch. putoria	128	34	68	6	192	278	128	112	946
	Total	2701	1850	4534	1547	910	1475	851	1342	15210

Table 4: Total number of non-biting flies from meat stalls at different times of the day

Meat stall	Time	Feb.	March	April	May	Sept.	Oct.	Nov.	Dec.	Total
Gariki	Morning	1859	1440	5850	785	915	182	210	396	11637
	Afternoon	2826	4392	617	0	1215	0	206	170	9426
	Evening	3348	3340	8184	1298	1324	1009	792	525	19820
	Total	8033	9172	14651	2083	3454	1191	1208	1091	40883
Artisan	Morning	3936	3465	4468	1598	1037	968	552	1324	17348
	Afternoon	2517	2549	1342	0	738	0	283	402	7831
	Evening	4134	2226	5274	2656	3508	1430	780	1368	21376
	Total	10587	8240	11084	4254	5283	2398	1615	3094	46555
New Haven	Morning	1144	717	1041	839	175	446	386	483	5231
	Afternoon	827	403	530	0	207	0	242	218	2427
	Evening	730	730	2963	708	528	1029	223	641	7552
	Total	2701	1850	4534	1547	910	1475	851	1342	15210

of the sun in the afternoons hampered their flying around in large numbers.

Conclusion

All the flies encountered in the three meat stalls studied belong to the non-biting species which are well-known to play a great role in the mechanical transmission of enteric diseases of man. Because of their powerful flight, house flies move about freely between indoor and outdoor attractions thereby constituting a lot of health hazard to man. The economic and public health significance of *Calliphora* species in the causation of pseudo and facultative myiasis are well known. As such much effort should be geared towards preventing them from getting in contact with human foods (both raw and cooked) and food items and where possible, make attempts at reducing their numbers greatly. Great fly control success could be achieved by simply improving hygienic standards in these markets and elsewhere.

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