Journal of the Egyptian Society of Parasitology, Vol.52, No.1, April 2022
J. Egypt. Soc. Parasitol. (JESP), 52(1), 2022: 159 - 168
(Online: 2090-2549)

INTEGRATED LYMPHATIC FILARIASIS ELIMINATION PROGRAM: PARASITOLOGICAL STUDIES AND FEASIBLE ELIMINATION PLAN IN MENSHIAT AL QANATER DISTRICT, GIZA GOVERNORATE, EGYPT

By

SALWA M.A. DAHESH[1*], MICHEAL W. MIKHAIL[1] AND AMANY M. AL- EMAM[2]

Research Institute of Medical Entomology (RIME), General Organization of Teaching Hospitals and Institutes[1], GOTHI and Endemic Diseases Control Administration of Giza[2], MOH & P, Egypt (*correspondence: salwamohamed970@gmail.com)

Abstract

Elephantiasis due to Lymphatic filariasis (LF) is one of the major causes of deformity and disability, known in Egypt since ancient times. In 2016, a new lf focus was discovered in Atris village, Menshiat Al Qanater District, Giza Governorate which was not included in NLFEP.

This work studied parasitological status in three villages in Menshiat Al Qanater; Atris, Kafr Abu Elhadid and Bani-Salama to plan a feasible elimination program.

Cross-sectional parasitological surveys were conducted from October 2017 to the end 2018 by visiting 10% of randomly selected houses. Finger prick blood samples were taken around midnight for thick blood films to detect the microfilarae. The results revealed that the overall prevalence of microfilaraemia was (0.6 %) in Menshiat Al Qanater district where 31 positive cases for MF out of 5568 examined persons. All cases were from two villages; Atris (21 cases), Kafr Abu Elhadid villages (10 cases), and none found in Bani-Salama village.

The planning an appropriate integrated vector management (IVM) LF program for Atris & Kafr Abu Elhadid were in altering the drug used in MDA to the triple drug regimen, vector management, and health promotion.

Keywords: Lymphatic filariasis, Giza endemic villages, epidemiologic survey, Elimination.

Introduction

Elephantiasis due to lymphatic filariasis (LF) is one of the major causes of deformity and disability. Globally, there are more than 120 million individuals have suffered from the disease distributed in eighty endemic countries (WHO, 2017a); 15 million (mainly females) had lymphedema or elephantiasis on leg(s) and 25 million men suffered from genital disease mostly hydrocele (WHO, 2012). Filariasis is caused by *Wuchereria bancrofti*. Also *Brugia malayi* and *B. timori* are causative agents (Simonsen *et al,* 2014).

In Egypt, vector was *Culex pipiens* as well as *Cx. antennatus* (Rifaat *et al,* 1970), Otsuji *et al.* (2011) reported that filariasis was presence since ancient times as given in Mentuhotep II (2000 years B.C.) and Queen of Punt (1501-1480 B.C.), and Ottesen *et al.* (1997) reported that archeologists reported filariasis in the Natsef-Amun mummy (3000 B.C.), Also, filariasis was a public health problem in the Nile Delta where the 2 biofoms *pipiens* and *molestus* of *Cx. pipiens* were the main vectors (Mahdi et al, 1969).

Egyptian Ministry of health and population conducted surveys in 141 urban & rural areas in 20 governorates from 1955 to 1965. They found that filariasis was endemic in 11 governorates; eight in Nile Delta, two in Upper Egypt and rural areas greater Cairo. In the Nile Delta, the prevalence was 7.2% in Qalyubia, 6.04% Sharkia, 2.7% Dakahlia & 0.9% Damietta. The prevalence was <1% in Beheira, Gharbia, Kafr Elsheikh & Menoufia. In Upper Egypt, prevalence was 1.2% in Giza & 0.9%, Assiut (Shawarby *et al,* 1965). However, the prevalence in some areas was up to 20% (Southgate, 1979). During the 1960s & 1970s, the MOH&P underwent filariasis control measures using DEC treatment protocol and vector control including residual house spraying and larviciding breeding places (Shawarby *et al,* 1968; Harb *et al,* 1993). Then, Ministry of health and population launched the National Filariasis Control Programme (NFCP) in the eight highly endemic MF governorates; Assiut, Dakahlia, Gharbia, Giza, Kafr Elsheikh, Menoufia,

Qalyubia & Sharkia relied on the selective DEC treatment and regular surveying of the endemic areas by well-developed of the rural health units. They used DEC (6mg/kg body weight) to treat positive microfilaria patients, with daily dose for twelve successive days (Weil *et al,* 1999). Although the prevalence greatly declined with number of endemic villages decreased from 350 to 178 by the end of 1990s, this DEC treatment strategy used only for LF was considered inappropriate to eliminate filariasis, yet 2.5 million people were still at risk, and filariasis resurgence in 1990s & 1998s occurred (Harb *et al,* 1993).

Again, the World Health Assembly called for eliminating LF as a public health problem by 2020 and WHO (2000) responded to this call and launched the Global Programme to Eliminate LF (GPELF). Egypt started national program to be one of the 1st countries to join the WHO (NLFEP) program. the GPELF and the NLFEP aimed to interrupt LF transmission by mass drug administration (MDA) of two combined drugs to alleviate the complications and disabilities caused by LF (WHO, 2003). The MDA was achieved by annual delivering of a single dose of albendazole (400mg) & DEC (6mg/kg body weight) for five successive years to all inhabitants of the endemic areas (El-Zanaty and Way, 2006) Because of highly developed the Ministry infrastructure 80% coverage of annual MDA was done. Evaluation of treated villages was achieved by post-MDA5 (five rounds). MDA was stopped in villages with prevalence less than the recommended threshold (WHO, 2009), and the last MDA8 (eight rounds) was stopped in 2014 (Dahesh and Ibrahim, 2018). In 2016, a new LF focus of 2% was detected in Atris village, Menshiat Al Qanater District which was never included in NLFEP (Ramzy *et al,* 2019).

The present study started by end of 2017 and during 2018 aiming to study parasitological situation in three villages in Menshiate Al Qanater, Atris, Kafr Abu Elhadid and Bani-Salama to plan a feasible integrated elimination program after WHO recommendations.

Subjects and Methods

Research design: Cross-sectional parasitological surveys were conducted from October 2017 to the end 2018 in Atris, Bani-salama and Kafr Abu Elhadid located in Menshiat Al Qanater District, Giza Governorate.

Study area: The present study was carried out in Menshiat Al Qanater District, which includes 23 villages over about 200 Km^2. The consensus of Menshiat Al Qanater was about 750,000 individuals in 2016. Menufia Governorate locates at North Nile River locates on the East, Awsim district on the South, and Kerdasa District on the West. The GPS of Menshiat Al Qanater district is 30.18257N, 31.11008 E. The villages Atris, Bani-Salama and Kafr Abu Elhadid were near to one another with GPS; 30.33477N, 30.88439E for Atris, 30.32062N, 30.84139E for Bani-Salama & 30.31292N, 30.88394E for Kafr Abu Elhadid. The inhabitants were 28,142 in Bani-Salama, 20,351 in Atris, & 9,149 in Kafr Abu Elhadid. The rural areas were prominent in the form of extended agriculture lands, many irrigation canals and agriculture drains. Majority of houses have pure drinking water, but lacked the proper sanitation. The houses with one or two floors got rid of sewage disposal pouring via permanent pipes in median uncovered drains in the villages' main roads. The majority of inhabitants were more or less of low socio-economic status.

Sample size: Big sample size was taken as the reference prevalence carried out in 2016 was very small 2.0% (Dahesh and Ibrahim, 2018). So, 10% of houses were visited to have the midnight blood samples. The number of the first house was chosen randomly then (ten) value was added for getting the number of the next house.

Inclusion criteria: All people inhabiting the chosen houses in the three selected villages (> one-year-old), who agreed to participate in the study.

Exclusion criteria: People or visitors who did not inhabit the selected village and also the children below one-year-old were excluded from the study. The study excluded babies because MF cannot be detected in the thick blood before the incubation period of the parasite (9-12 months).

Parasitological survey: The inhabitants of 10% of randomly selected houses were asked for contributing in the present study where written agreements besides their personal data were taken from adults for themselves and for their children. The survey was carried out at night from 9:00 pm to 2:00 am O'clock. Finger prick blood samples were taken (20 micron), thick blood films were prepared and stained by Giemsa stain then the stained films were examined microscopically under low and high powers. Three or five slides were prepared for the positive cases to detect the mean count of microfilaria/20 micron blood (WHO, 2017a). Personal data of the examined individual as address, name, age, sex and mobile number were collected.

Ethical considerations: All were educated about LF transmission and vectors control. Their benefits were the free them from microfilariae, treatment and follow up. Treatment was 400mg Albendazole® and DEC® (6mg/kg diethyl carbamazine citrate) once each six months. The participated adults had autonomy for agreement on their written consents. Children consents were got from parents or guard-father. The study was approved by the Ministry of Health and Population after approval by the Research Ethical Committee of the General Organization of Teaching Hospitals and Institutions GOTHI, which agreed with rules of Helsinki (2000)

Statistical analysis: Data were tabulated and analyzed by using SPSS version 20 for windows software packages. Homogeneity and Leven tests were used for continuous variances. Descriptive analysis categories were as mean and SD to inhabitants' age and MF densities. A comparison between arithmetic mean age of positive & negative cases was done using Student's t-test. Age variable was categorized into ordinal groups to detect age group with highest microfilariae prevalence. Chi square compared nonparametric proportions. Z-test or Fisher's exact was used of sparse data (Rosner, 2015). Significance was at 0.05 in a two-tailed fashion.

Results

The results were given in tables (1, 2, 3, 4, 5, 6, 7 & 8) and figure (1 & 2)

Table 1: Filariasis in Atris, Bani-Salama and Kafr Abu Elhadid, Menshiat Al Qanater District.

village		Negative	Positive	Total
Atris	No.	1977	21	1998
	%	98.9%	1.1%	100.0%
Bani-Salama	No.	2690	0	2690
	%	100.0%	0.0%	100.0%
kafr Abu Elhadid	No.	870	10	880
	%	98.9%	1.1%	100.0%
Total	No.	5537	31	5568
	%	99.4%	0.6%	100.0%

Chi-Square= 29.218, P<0.001

Table 2: MF among Atris and kafr Abu Elhadid the villages, Menshiat Al Qanater District.

MF / 20 micron blood		Atris	Kafr Abu Elhadid	total
Low (1-10)	NO.	14	9	23
	%	66.7%	90.0%	74.2%
Middle (11-50)	NO.	6	1	7
	%	28.6%	10.0%	22.6%
High(51+)	NO.	1	0	1
	%	4.8%	0.0%	3.2%
Total	NO.	21	10	31
	%	100.0%	100.0%	100.0%

Low= (1-10MF/ 20 micron blood), middle= (11-50 MF / 20 micron blood), and high= (51MF / 20 micron blood).
Chi- Square= 2.008, P=0.366

Table 3: MF cases in Atris & Kafr Abu Elhadid villages, Menshiat Al Qanater District, Giza governorate.

Serial No.	Village	Sex	Age	MF/20 micron blood
1	Atris	Male	17	0.8 ± 0.5 (n= 5)
2	Atris	Male	39	18.0 ± 5.2 (n= 3)
3	Atris	Male	40	1.0±0.5 (n-5)
4	Atris	Female	67	18.0 ± 5.5 (n= 3)
5	Atris	Male	60	7.0 ± 2.5 (n= 3)
6	Atris	Male	75	77.0 ± 15.0 (n= 3)
7	Atris	Male	38	3.0 ± 1.2 (n= 5)
8	Atris	Female	45	3.0 ± 0.5 (n= 5)
9	Atris	Male	29	16.5 ± 4.5 (n= 3)
10	Atris	Male	38	10.5 ± 3.0 (n= 3)
11	Atris	Female	8	5.0 ± 1.5 (n= 5)
12	Atris	Male	80	4.0 ± 1.0 (n= 5)
13	Atris	Female	40	4.0 ± 1.5 (n= 5)
14	Atris	Male	27	35.0 ± 6.0 (n= 3)
15	Atris	Male	27	8.0 ± 0.5 (n= 3)
16	Atris	Male	29	21.0 ± 3.5 (n= 3)
17	Atris	Male	31	2.0 ±0.5 (n= 5)
18	Atris	Male	40	6.0 ± 0.5 (n= 3)
19	Atris	Male	35	17.0 ±6.5 (n= 3)
20	Atris	Male	45	6.0 ±2.0 (n= 3)
21	Atris	Male	63	2.0 ±0.5 (n= 5)
22	Kafr Abu Elhadid	Male	15	2.0 ±0.8 (n= 5)
23	Kafr Abu Elhadid	Male	32	2.0 ±1.0 (n= 5)
24	Kafr Abu Elhadid	Male	15	4.0 ±1.5 (n= 5)
25	Kafr Abu Elhadid	Male	80	3.0 ±0.8 (n= 5)
26	Kafr Abu Elhadid	Female	40	8.0 ± 4.5 (n= 3)
27	Kafr Abu Elhadid	Male	85	3.0 ±1.0 (n= 5)
28	Kafr Abu Elhadid	Male	55	1.0 ± 0.5 (n= 5)
29	Kafr Abu Elhadid	Male	14	5.0 ± 1.5 (n= 3)
30	Kafr Abu Elhadid	Female	31	6.0 ± 2.0 (n= 3)
31	Kafr Abu Elhadid	Male	48	13.0 ± 7.5 (n= 3)

Table 4: Comparison between Atris and Kafr Abu Elhadid villages, Menshiat Al-Qanater as to MF density and ages

Variable	Village	No.	M ±SD	Std. Error Mean	Significance
Parasite density	Atris	21	12.90±16.91	3.69	T= 2.124
	Kafr Abu Elhadid	10	4.70±3.59	1.13	P= 0.044*
Age	Atris	21	42.71±16.83	4.00	T=0.158
	Kafr Abu Elhadid	10	41.50±25.73	8.13	P= 0..876

Table 5: MF as to age group and parasite density in Atris and Kafr Abu Elhadid, Menshiat Al Qanater District

Age group	No. & %	Parasite density			Total
		Low (1-10)	Middle (11-50)	High (51+)	
1-10 y	No. & %	0a (0.0%)	0a (0.0%)	0a (0.0%)	0.0%
11-20 y	No. & %	4_a (17.4%)	0_a (0.0%)	0_a (0.0%)	4 (12.9%)
21-30 y	No. & %	3_a (13.0%)	3_a (42.9%)	0_a (0.0%)	6 (19.4%)
31-40 y	No. & %	8_a (34.8%)	2_a (28.6%)	0_a (0.0%)	10 (32.3%)
41-50 y	No. & %	2_a (8.7%)	1_a (14.3%)	0_a (0.0%)	3(9.7%)
51-60 y	No. & %	2_a (8.7%)	0_a (0.0%)	0_a (0.0%)	2 (6.5%)
61-70 y	No. & %	1_a (4.3%)	1_a (14.3%)	0_a (0.0%)	2 (6.5%)
71-90 y	No. & %	$3_{a, b}$ (13.0%)	0_b (0.0%)	1_a (100.0%)	4 (12.9%)
Total	No. & %	23 (100.0%)	7 (100.0%)	1 (100.0%)	31(100.0%)

Low= (1-10MF/ 20 micron blood), middle= (11-50 MF / 20 micron blood), and high= (51MF / 20 micron blood).

Table 6: Filariasis among Atris and Kafr Abu Elhadid, Menshiat Al Qanater District as to sex

Lymphatic filariasis		Male	Female	Percentage
Negative	No.	1505_a	1342_b	2847
	%	52.9%	47.1%	100.0%
Positive	No.	25_a	6_b	31
	%	80.6%	19.4%	100.0%
Total	No.	1530	1348	2878
	%	53.2%	46.8%	100.0%

A= Sex categories whose column proportions without significantly at the 0.05 level. Chi-Square= 9.506, P= 0.002
Column proportion with letter a differed significantly from that with letter b

Table 7: Comparison between male and female filarial cases according to parasite densities.

Parasite density		N	MF / 20 micron blood)	Std. Error Mean	Sig.
Sex	Male	25	10.960±15.917	3.1835	T=0.544
	Female	6	7.333±5.501	2.2460	P=0.361

Table 8: Comparison between LF prevalence in Atris village in 2016 & 2018.

Result		2016	2018	Significant
Negative	No.	448	1977	Pearson Chi-Square= 2.598 P= 0.152
	%	98.0%	98.9%	
Positive	No.	9	21	
	%	2.0%	1.1%	
Total	No.	457	1998	
	%	100.0%	100.0%	

Discussion

All villages included in NLFEP and implemented the annual MDA and evaluated through Transmission assessment surveillances TAS, showed elimination or reduction of their LF prevalence to less than the threshold of WHO (Ramzy *et al* 2019; Ramzy *et al,* 2020). In 2016, the LF survey in Menshiat Al Qantter district covering seven villages; Abu Ghaleb, Al Hager, Bani-Salama, Atris, Al Qata, Wardan, and Kafr Abu Elhadid during July-September. Blood samples of 2,108 persons were collected at night and prepared then stained and microscopically examined for presence of MF. Although the overall LF prevalence of Menshiat Al Qanater District (0.5%), yet was below the threshold of WHO, LF prevalence of one village, Atris that exceeded the recommended threshold (2.0%) where nine cases were discovered out of 457 examined individual. Also two cases in the same house were positive for MF in 0.4% Bansi-Salama village out of 273 examined individuals (Dahesh and Ibrahim, 2018). Furthermore, a child had very low microfilaraemia was recorded in 2017 in Kafr Abu Elhadid village close to both Atris and Bani-Salama villages. So, the present study focused on these villages in Menshiat Al Qanater to conduct parasitological survey, analyzing the situation to suggest appropriate feasible plan integrated elimination of filariasis in villages with prevalence more than the WHO threshold.

The present study found that the overall prevalence of microfilaraemia was (0.6%) in Menshiate Al Qanater District as 31/5568 cases were MF positive. All cases were residents in two villages; Atris (21 cases) and Kafr Abu Elhadid villages (10 cases), but none in Bani-Salama village.

Bani-Salama village was the last village, which patients received MDA annually for eight successive years as a single albendazole dose and DEC targeting people above 5 years from 2007 till 2014. The last transmission assessment surveillance carried out among school children in 2017 didn't record antigenaemia in this village. By asking the two cases reported in 2016 in Bani-Salama, they said that they refused receiving the doses along the period of NLFEP, but their families received MDA covered 86.7% of the target population (Dahesh and Ibrahim, 2018). Consequently, the absence of positive cases among large sample size of Bani-Salama population indicated that this village didn't require further elimination measures.

In the present study, Atris village showed LF prevalence of (1.1%) as 21/1998 was positive MF cases. The survey of 2016 2.0% was positive that markedly decreased, but without significant difference between 2016 & 2018. The reduction in parasite rate may be due to fact that the cases of 2016 inhabited or focused along one road which received MDA just after the survey of 2016 for the 2016 & 2017 years by Giza Governorate Endemic Diseases Control Administration. However, Atris prevalence was still higher than the target threshold as the village was not included in the national lymphatic filariasis program and thus Atris village still required LF elimination program.

In the present study, Kafr Abu Elhadid, the smallest village with the lowest number of

population and close to the endemic Atris village, a child had microfilaria. This may suggest the probability to be MF endemic village. Nevertheless, LF prevalence in Kafr Abu Elhadid (1.1%) was slightly higher than target threshold, and required planning and implementing an appropriate eliminateion program as this village neither was included in either NLFEP (2007- 2014) nor received MDA.

Both Atris and Kafr Abu Elhadid villages had the same LF prevalence (1.1%) with mean positive microfilaraemia in Atris village (12.90 ±16.91 MF/20µm. blood), which was significantly higher than that of Kafr Abu Elhadid (4.70±3.59 MF/20µm. blood). Also, positive cases (90%) in Kafr Abu Elhadid village had low parasitaemia (less than 10MF/20µm.blood), and Atris village showed highest density level (more than 50 MF/ 20µm. blood). This was a male aged 75years with parasite density (77.0±15.0MF/20µm. blood).

The present results showed that transmission started first in Atris village then, infection was contracted to Kafr Abu Elhadid village with 2.0% prevalence during the 2016 survey without cases were detected in Kafr Abu Elhadid (Dahesh and Ibrahim, 2018).

In the present study, most of the MF positive cases (26) were males (80.6%) while the rest were females, with significant difference. This agreed with 2016 study as 81.8% positive cases were males (Dahesh and Ibrahim 2018). Also, Abdel Shafi *et al*. (2016) reported higher filariasis among males 80%. Abroad the present result agreed Nelwan *et al*. (2001); Weerasooriya *et al*. (2002) and Braga *et al*. (2003). However, Nuchprayoon *et al*. (2003) in Thailand and Weil *et al.* (1999) in Nile Delta did not find difference between sexes using different immunological tests.

This may attribute to the longer males exposure to infective mosquito bites during their work out-doors at night. The breeding places in agriculture drain surrounding the houses contained high densities of mosquito larvae and suitable for laying eggs. After the infective gravid females lay their eggs in the breeding places outside the houses, the female mosquitos become hungry waiting the nearest chance to bite the host for getting the next blood meal.

Concerning the parasite densities in both sexes, the mean number of microfilaria in blood was higher in males (10.96 ±15.91 MF/ 20 micron blood) than that of females (7.33 ±5.50 MF/ 20 micron blood). The difference was not statistically different. The higher microfilaria densities in males may attribute to the infective mosquito bites as males working at night near breeding places.

Concerning the age of positive cases in the present study, the result revealed that the mean age of positive male and female group were 42.71±16.83 & 41.50±25.73 years respectively. Most of positive cases (61.4%) were allocated into age groups from 20 to 50 years while no positive case was less than ten years. Likewise in previous studies, similar results were obtained (Abd El-Sahafy *et al* 2016).

WHO validated Egypt as the first country in the Eastern Mediterranean Region in December 2017 in achieving the required criteria for eliminating lymphatic filariasis as a public health problem. WHO also recommended and supported the continuous tracing and discovering the predicted new spots and eliminating the remaining residual focus (Ramzy *et al*, 2019; 2021). After detecting a small new focus in Atris, the village was not included in the 2016 NLFEP (Dahesh and Ibrahim, 2018), and all positive cases were treated with MDA in the form as single dose albendazole and DEC for 2016 & 2017 years and followed up.

The present study was considered an episode in a series of discovering and eliminating the LF focus in Menshiat Al Qanater District. According to the results of the present study, only Atris and Kafr Abu Elhadid villages were the villages require an appropriate integrated elimination program where there prevalence slightly exceeded the recommen-

ded threshold. By the situation analysis from 2016 to the present study, some point must be considered in eliminating LF in these villages:

1- An annual MDA using the alternative triple drug regimen should be carried out. The triple drug regimen is in the form of ivermectin (200ug/kg), albendazole (400mg) besides DEC (6mg/ kg body weight) according to guideline of (WHO, 2017b) may accelerate clearance of microfilaria and interrupt the transmission (Ramzy *et al*, 2006; WHO, 2017b; Graves *et al*., 2021; Weil *et al*., 2021) where since 2016, during the follow up of the cases it was noticed that the treatment of cases by a single dose of albendazole (400mg) plus DEC (6mg/kg body weight) did not clear microfilaria in blood and some cases still had microfilaria even after the third dose .

2- Implementing integrated vector management IVM, the most effective approach, as IVM was considered a rational decision-making process to interrupt transmission via the optimum use of resources for obtaining efficient, cost-effective and sustainable vector control (WHO, 2017c). The following points should be taken into consideration during implementing IVM: a- It is important to collaborate with the authorities responsible for environment for collecting and getting rid of the garbage and wastes that accumulated and covered the breeding places of mosquitos and constituted an obstacle preventing the larvicides from reaching the larvae in water, b- Susceptibility test of the larval mosquitos to various larvicides should be carried out before implementing the appropriate effective control of breading places (WHO, 1981), c- Susceptibility test of adult mosquitoes to various insecticides should be carried out before painting the houses of the positive cases and the neighboring houses using indoor residual spraying application (WHO, 2022), d- Timing of painting the walls of positive cases and neighboring houses with appropriate insecticide of residual eff ect was very important. Painting house with residual insecticide must be just before mass drug administration MDA to ensure that the infective adult mosquitos in houses of the positive cases carrying L_3 were eradicated, and the inhabitants receiving MDA would not be re-infected as transmission was interrupted, and e- Post MDA and IVM assessment mustbe carried out to decid the continuity or stopping the MF treating program.

3-Health promotion: The process of health promotion helps people in increasing control over, and improving their health. It focuses on the behavior of individuals towards a great range of environmental and social interventions (WHO, 2017d). Steps in health promotion can be achieved for synergizing the effect of the elimination program as: a- Continuous health education for all community about mode of LF transmission and various method of control, b- Encouraging the inhabitants to collaborate and participate in removing garbage and covering all uncovered drains that constitute the main source of mosquitos, and c- Supporting and encouraging inhabitants to call continuously the Authorities of Governmental or non-Governmental Organizations for establishing good sanitation, paving roads, and getting rid of the accumulated tranches, litter, refuse and the likes....etc.

Conclusion

The present study highlighted the 3 MF villages Menshiat Al Qanater: Bani-Salama, Atris and Kafr Abu Elhadid.

Atris and Kafr Abu Elhadid villages had MF prevalence slightly exceeded the WHO target threshold and require an appropriate elimination program as they were not included in the GPELF.

All criteria of planning an appropriate feasible integrated elimination LF program for these two villages were given.

Recommendations

1- Encouraging health promotion strategy through collaboration of governmental and nongovernmental organizations to improve all life style including sanitation, paving roads…etc. 2- All villages surrounding areas

should be examined. 3- Diagnosis by using rapid diagnostic tests at the morning where the sampling for preparing thick blood film in these remote villages at the total darkness night was very difficult where there was no electricity illuminating the unpaved roads furthermore there was no transportation at night.

Authors' contribution: Dahesh SMA did all field and supervised lab work, Mikhail M W shared examination of thick films and writing the manuscript. Al-Emam AM, supervised samples collection, treating cases and facilitated the field work.

Authors' declaration: Authors declared that they neither have special interest in this work nor received fund.

Acknowledgments

The authors would like to thank Dr. Ayat Haggag formerlyUnder Secretary of Endemic Diseases Control, MOH&P, Dr Nabila Kandeel, General Manager of Administration of endemic Disease Control in Giza, Dr Sawsan Nada, Bader Abd El-Fatah, Gamilla Ali, Fatma Mustafa and all members Malaria and Filaria Training Center. Thanks are also to Prof. Dr. Reda Ramzy for great support and continuous motivation.

References

Abdel-Shafi, IR, Shoeib, EY, Attia, SS, Rubio, JM, ElBadry, AA, 2016: *Wuchereria bancrofti* microfilariae and quantitative selected circulating antigens detection in selected endemic areas in Egypt. Kasr Al Ainy Med. J. 22:34-40.

Braga, C, Dourado, MI, Ximenes, RA, Alves, L, Brayner, F, Rocha, A, *et al*, 2003: Field evaluation of the whole blood immunochromatographic test for rapid bancroftian filariasis diagnosis in the northeast of Brazil. Rev. Inst. Med. Trop. Sao Paulo 45:125-9.

Dahesh, SMA, Ibrahim, BF, 2018: Update on filariasis in villages of Menshiat Al Qanater District, Giza Governorate, Egypt. PUJ 11:32-43.

El-Zanaty, F, Way, A, 2006: Egypt Demographic and Health Survey 2005. http://www. dhsprogram.com/ pubs/pdf/FR176/FR176.pdf.

Graves, PM, Sheridan, S, Scott, J, Sam, F, Naseri, T, *et al,* 2021: Triple-Drug Treatment Is Effective for Lymphatic Filariasis Microfilaria Clearance in Samoa. Trop Med Infect Dis.1; 6(2):44. doi: 10.3390/tropicalmed6020044.

Harb, M, Faris, R, Gad, AM, Hafez, ON, Ramzy, R, *et al,* 1993: The resurgence of lymphatic filariasis in the Nile Delta. Bull. WHO 71:49-54.

Mahdi, AH, Wasif, SF, Gad, AM, 1969: Biological studies of *Culex pipiens*, in the Nile Delta. Part I screening to filarial infection. J. Egypt. Publ. Hlth. Assoc. 44:189-92

Nelwan, RHH, 2001: Filariasis in the new millennium. Med J Indones; 10:191-196.

Nuchprayoon, S, Porksakorn, C, Junpee, A, Sanprasert, V., Poovorawan, Y, 2003: Comparative assessment of an Og4C3 ELISA and an ICT filariasis test: a study of Myanmar migrants in Thailand. Asian Pac J Allergy Immunol; 21:253-257.

Ottesen, EA, Duke, BOL, Karam, M, Behbehani, K, 1997: Strategies and tools for control/ elimination of lymphatic filariasis. Bull WHO 75:491-503.

Otsuji, Y, 2011: History, epidemiology and control of filariasis. Trop. Med. Hlth. 39, 2:S3-13.

Shawarby, AA, Naguib, K, Moharram, A, 1965: Incidence of filariasis in Egypt. J. Egypt. Publ. Hlth. Assoc. 40:268-82.

Rosner, B, 2015: Descriptive Statistics Inference, Hypothesis Testing: One-Sample Inference, Hypothesis Testing: Categorical Data In: Fundamentals of biostatistics. Nelson, Ceng-age Learning.

Ramzy, RMR, El Setouhy, M, Helmy, H, *et al*, 2006: Effect of yearly mass drug administration with diethylcarbamazine and albendazole on bancroftian filariasis in Egypt: a comprehensive assessment. Lancet 367, 9515:992-9.

Ramzy, RMR, Kamal, HA, Hassan, MA, *et al*, 2019: Elimination of lymphatic filariasis as a public health problem from the Arab Republic of Egypt. ActaTrop.199:105-21.

Ramzy, RMR, Al Kubati, A, 2021: Progress towards elimination of lymphatic filariasis in the Eastern Mediterranean Region, Inter. Hlth. 13, 1:S28-32.

Rifaat, MA, Mahdi, AH, Wassif, SF, Morsy, TA, 1970: Laboratory efficiency ratio of *Culex pipiens* and *C. antennatus* as filaria vectors in U.A.R. J. Egypt. Pub. Hlth. Assoc. 25:266-70.

Shawarby, AA, Mahdi, AM, Taha, AM, Mahmoud, WA, Arafa, MA, *et al,* 1968: Bancroftian filariasis in United Arab Republic: Assess-

ment of control measures 1963-66. J. Egypt. Publ.Hlth. Assoc. 43:79-99.

Simonsen, PE, Fischer, P, Hoerauf, A, Weil, GJ, 2014: The filariasis in Manson's Tropical Diseases. 23rd edition.

Weerasooriya, MV, Gunawardena, NK, Itoh, M, Qiu, XG, Kimura, E, 2002: Prevalence and intensity of *Wuchereria bancrofti* antigenaemia in Sri Lanka by Og4C3 ELBA using filter paper-absorbed whole blood. Trans. R. Soc. Trop. Med. Hyg. 96:41-5.

Weil, GJ, Ramzy, RMR, El Setouhy, M, Kandil, A, Ahmed, ES, *et al,* 1999: longitudinal study of bancroftian filariasis in the Nile delta of Egypt: baseline data and one year follow-up. Am. J. Trop. Med. Hyg. 61:53-8.

Weil, JG, Ramzy, RMR, 2007: Diagnostic tools for filariasis elimination programs. Trends Parasitol. 23, 2:78-82.

Weil, GJ, Jacobson, JA, King, JD, 2021: A triple-drug treatment regimen to accelerate elimination of lymphatic filariasis: From conception to delivery. Int. Hlth.13, 1:S60-4.

WHO, 1981: Instruction for determining the susceptibility or resistance of adult mosquitoes to organochlorine, organophosphate and carbamate insecticides-diagnostic test: WHO/ VBC/81.806.

WHO, 2000: Preparing and Implementing a National Plan to Eliminate Lymphatic.

WHO, 2003: The Global Elimination of Lymphatic Filariasis: The Story of Egypt. https:// apps.who.int/iris/handle/10665/69664.

WHO, 2009: Eighth meeting of the Regional Programme Review Group on elimination of lymphatic filariasis. Geneva, Switzerland.

WHO, 2013: Global programme to eliminate lymphatic filariasis: Progress report for 2012. Epidemiol. Rec. 88:389-99.

WHO, 2017a: Lymphatic filariasis, Epidemiology. Geneva, Switzerland.

WHO, 2017b: Guideline: Alternative Mass Drug Administration Regimens to Eliminate Lymphatic filariasis. CC BY-NC-SA 3.0 IGO. Geneva, Switzerland.

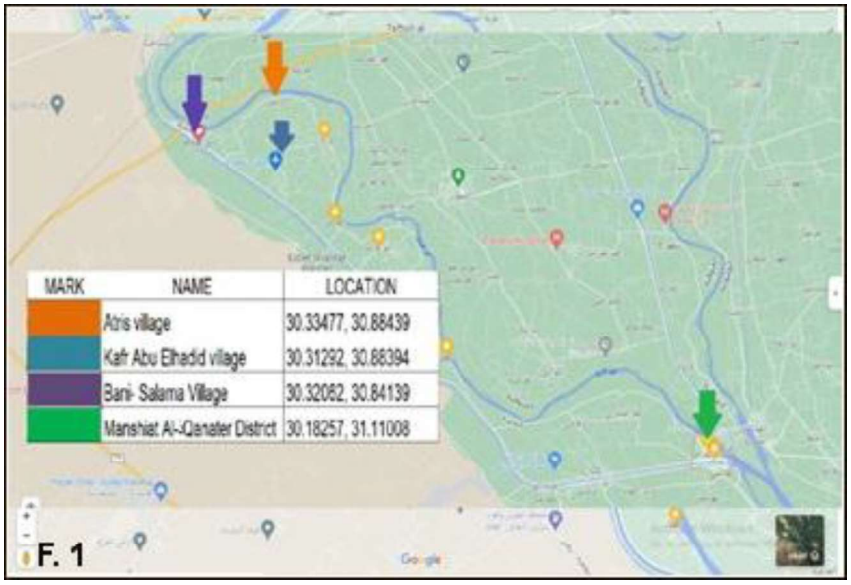
WHO, 2017c: Global Vector Control Response 2017 to 2030. Geneva, Switzerland.

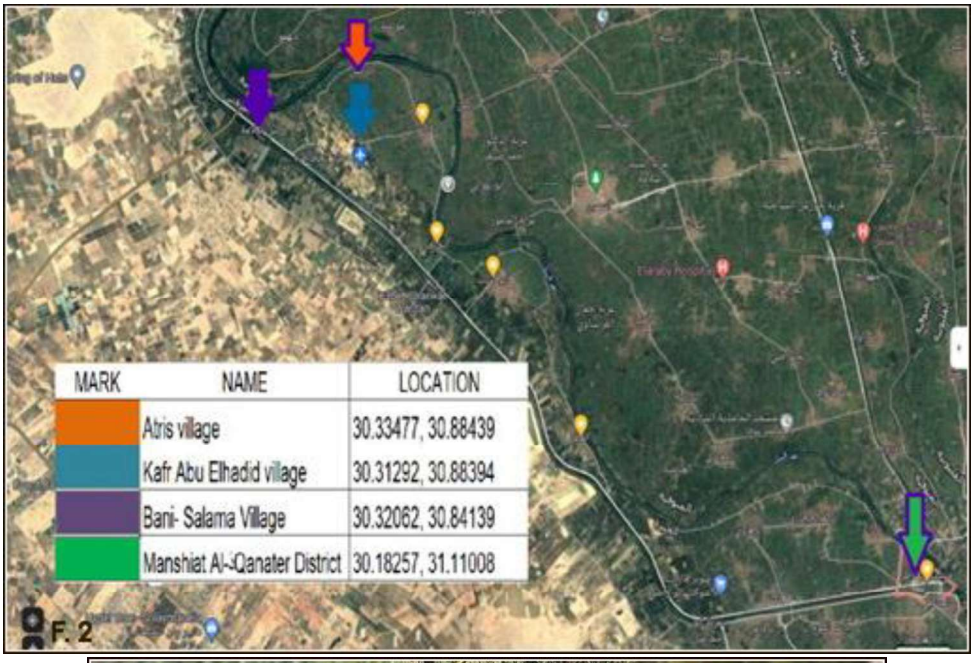
WHO, 2017d: Regional Action Plan on Health Promotion in the Sustainable Development Goals: 2018-2030. Geneva, Switzerland.

WHO, 2022: Standard operating procedure for testing insecticide susceptibility of adult mosquitoes in WHO bottle bioassays. Geneva, Switzerland.

Explanation of figures

Fig. 1: Mashiat Al-Qanater District showed Atris, Kafr Abu-Elhadid and Bani-Salama villages
Fig. 2: Mashiat Al-Qanater District showed Atris, Kafr Abu-Elhadid and Bani-Salama villages
Fig. 3: Field collection of mosquito larvae from a water drainage.
Fig. 4: Detected microfilaria in peripheral blood of a patient.




MARK
NAME
LOCATION
Atris village
30.33477, 30.88439
Kafr Abu Elhadid village
30.31292, 30.88394
Bani- Salamia Village
30.32062, 30.84139
Manshiat Al-Qanater District
30.18257, 31.11008
F. 2


F. 3


F. 4

CONSULTANT BOARD

Community, Environmental and Occupational Medicine:
Prof. Dr. Aisha Mohammad A. El-Gamal, Faculty of Medicine, Ain Shams University,
Dermatology and Venereology:
Prof. Dr. Nayera H. Moftah, Dean, Faculty of Medicine, Al-Azhar University for Girls,
Entomology:
Prof. Dr. Mamdouh M. Nassar Mahmoud, Faculty of Science, Cairo University,
Surgery:
Prof. Dr. Alaa El Din Ismail, Faculty of Medicine, Ain Shams University,
Prof. Dr. General Yasser Ahmed El Sayed, Military Medical Academy, Cairo,
Internal Medicine:
Prof. Dr. Magdy A. Eldahshan, Faculty of Medicine, Al-Azhar University, Nasr City,
Malacology:
Prof. Dr. Shadia M. El-Dafrawy, Theodore Bilharz Research Institute, Giza, Egypt,
Medical Microbiology and Immunology:
Prof. Dr. Nehal Mohammed Anwar Fahim, Faculty of Medicine, Ain Shams University,
Ministry of Health and Population:
Prof. Dr. Ayat A. M. Haggag, Under-Secretary for Endemic Diseases, Cairo, Egypt,
Prof. Dr. Micheal William Mikhail, Research Institute of Medical Entomology, Dokki,
Nursing:
Prof. Dr. Howyida Sadek Abdelhameed, Dean, Faculty of Nursing, Benha University,
Prof. Dr. Laila Abdel-Mawla Megahed, Military Medical Academy, Cairo, Egypt,
Pediatrics:
Prof. Dr. Hamed Mahmoud Shatla, Faculty of Medicine, Ain Shams University,
Toxicology of Pesticides:
Prof. Dr. Didair Ahmad Ragheb Wasef, Faculty of Agriculture, Zagazig University,
Tropical Medicine and Infectious Diseases:
Prof. Dr. Maysaa Abdallah Saeed, Faculty of Medicine, Zagazig University,
Zoology:
Prof. Dr. Fathy Abdel Aaty Abdel Ghaffar, Faculty of Science, Cairo University,
Zoonosis Diseases:
Prof. Dr. Maha Ahmad Sabry Mahmoud, Faculty of Veterinary-Medicine, Cairo University.

*****

PAST-PRESIDENTS SINCE THE FOUNDATION OF THE SOCIETY

1969-1987: Prof. Dr. Mahmoud Hafez, Faculty of Science, Cairo University,
1988-1996: Prof. Dr. Hamid M. Khalil, Faculty of Medicine, Ain Shams University,
1997-2002: Prof. Dr. Nabil Taha Nasr, Faculty of Medicine, Cairo University,
2003-2009: Prof. Dr. Mohsen M. Hassan, Faculty of Medicine, Zagazig University,
2010-2019: Prof. Dr. Abdelhammed Abdel-Tawab Sabry, Faculty of Medicine, Fayoum University.