Benha Journal of Applied Sciences (BJAS) print: ISSN 2356–9751
Vol. (8) Issue (5) (2023), (323-330) online: ISSN 2356–976x
http://bjas.journals.ekb.eg

Studies on Pesticides Residues in Fish in Menofia Governorate

Amal A.A.Farag[1], Saad M. Saad[1], Fahim A. Shaltout[1], Hashim F. Mohammed[2]
[1]Department of Food Control, Faculty of Veterinary Medicine, Benha University, Egypt.
[2]Animal Health Research Institute, Doki branch, Giza, Egypt.
E-mail: fahim.shaltout@fvtm.bu.edu.eg

Abstract
A total of 90 samples of fish (each 45 samples of Tilapia Nilotica and 45Claris Lazera) were collected from EL-Bagoria canal, EL-Menofy drainage and Bahr Shibin in Menofia governorate and analyzed to detect and determine Organochlorine (DDT, aldrin and dieldrin) and organophosphorus (diazinon, Malathion and chlorpyrifos). Organochlorine and organophosphorus pesticides could not be detected in Bahr Shibin while mean value of DDT in Tilapia Nilotica from EL-Bagoria canal was 0.37±0.09, aldrin was 0.33±0.03and dieldrin was 0.50±0.20 while in EL-Menofy drainage mean level of DDT was 0.34±0.07, aldrin was 0.40±0.08 and dieldrin was0.40±0.13. While in Claris Lazera samples from EL-Bagoria canal mean level of DDT was 0.40±0.46, aldrin was 0.25±0.07and dieldrin was 0.34±0.08 while from EL-Menofy drainage mean value of DDT was 0.27±0.05, aldrin was 0.30±0.07 and dieldrin was 0.48±0.10. Concerning organophosphorus compounds, no diazinon was recorded in Tilapia Nilotica from EL-Bagoria while mean level of Malathion from EL-Bagoria was 5.50±2.0, the mean level of chlorpyrifos was 5.0±1.66.whie from EL-Menofy drainage the mean level of diazinon was 3.33±0.65, the mean level of Malathion was 4.98±1.22 ,the mean level of chlorpyrifos was 3.0±0.71.while in Claris Lazera samples from EL-Bagoria there were no diazinon , no Malathion no chlorpyrifos while from EL-Menofy drainage ,the mean level of diazinon was 6.8± 1.42 , the mean level of Malathion was 4..64±0.81 and the mean level of chlorpyrifos was 4.0±0.96. Pesticides are one the main contaminants of water sources that act as the natural environment of fish. On the other hand, fish contaminated by pesticides either directly by gills breathing or indirectly through contamination of feeding items, so it is very important to analyze fish samples to detect to what extent the rate of accumulation of pesticides residues in fish flesh and organs.

Keywords: Organochlorine pesticides, DDT, aldrin, dieldrin, organophosphorus pesticides, diazinon, Malathion, chlorpyrifos, HPLC

Introduction

Fish is low-fat high-quality protein and a great source of omega-3, fatty acids, and vitamins such as DandB2(riboflavin). Fish is rich in calcium and phosphorus. Fish is a wonderful source of iron, zinc, iodine, magnesium, and potassium. A healthy diet should include fish at least twice an according to the American Heart Association. The protein, vitamins and nutrients that are abundant in fish can lower blood pressure and help in lowering the risk of a heart attack or stroke. Because it is readily available and delicious fish is consumed by a higher percentage **(Shaltout,2003;Hassan et al.,2014; Edris et al.2017a and Saad et al.2022).**

Fish is also known to be highly nutritious and good source of animal protein**.** Due to their high worldwide commerce volume, fish and fish products are in the forefront of food safety and quality development. As one of the most affordable sources of animal protein, fish and fish products are among the most essential food items. According to, **Shaltout,2003; Hassan et al.,2014; Edris et al.,2017 and Saad et al.,2022).** Fish are packed with vital minerals, vitamins, and unsaturated fatty acids. Environmental contamination is one of the biggest issues facing the globe today. One of the main areas of research in 1962 was the negative impact of pesticide poisoning on the environment. Several committees responded to the issue of pesticide residues in food at the international level through several committees by United Nations Organization **(FAO,WHO,1987)**. Organochlorine chemicals and their metabolites have been documented to contaminate food of animal origin in a number of nations **(Neumann,1988 and Goldman et al.1990).** Organochlorine pesticide residues have been found in a variety of foods including fish. The excessive use of pesticides in Egypt created a number of issues and many have posed risks to fish. Water contamination by pesticides can enter natural water sources directly by using pesticides to control aquatic weeds and insects or indirectly by using various agricultural chemicals , then disposing of the waste dumps as well as cleaning up the various containers used to store pesticide formulations. The prescence of such pesticides in fish, water and sediments has been mentioned by numerous researchers in Egypt. **(EL-Sarnagawy and Rizk 1978, Abou EL-amyem et al. 1979; EL-Dib and Badawy1985; Abdel Gawaad et al.,1989 and EL-Gazzar et al.,1989 and Abou-Donia, 1990)**. Fish has been found to contain significant levels of organochlorine pesticides in fish flesh and has been reported as proof of contamination of fish. Less lasting organochlorine pesticide, organophosphorus pesticides frequently significantly lower the standing group of fish by reducing their nutritional base and or interfering with different stages of fish development.

Aim of work:

This investigation aims to identify and determine in Nile Tilapia and Claris Lazera samples from EL-Bagoria canal, El-Menofy drainage and Bahr Shibin in Menofia Governorate included Organochlorine and organophosphorus pesticides.

Materials and Methods:

For the purpose of detecting and determination of Organochlorine (DDT, Aldrin and dieldrin) and organophosphorus (Diazinon, Malathion and chlorpyrifos) 90 fish samples of Tilapia Nilotica and Claris Lazera (45 of each kind) from EL-Bagoria canal, EL-Menofy drainage and Bahr Shibin in Menofia Governorate for detection and determination of Organochlorine (DDT, Aldrin and Dieldrin) and organophosphorus (Malathion, Diazinon and chlorpyrifos)

The collected samples were packed separately and transferred to laboratory for chemical examination.

Determination of Organochlorine pesticides:

Organochlorine pesticides were identified using samples that were extracted in accordance with the **AOAC,1980 and Pesticide Analytical Manual, 1978**.

Fifty 50 gram of samples were ground for two times in a mill with 100 gram of anhydrous sodium sulphatein and 150gram of 40-60petroleum ether for 2 minutes then extract was decanted through 500ml Buchnov funnel containing two wattman filter papers number 1,2 to remove the solids.

The extract was concentrated by passing it through 40x̧25mmcolumn of anhydrous sodium sulphate collecting the elutent in 500ml flask using a rotary evaporator to concentrate the extract. Acetonitrile saturated with petroleum ether and clean up on extraction with diethyl ether in petroleum ether were used to remove the pesticide residues from the fat. In a rotator evaporator, the eluate was concentrated then it was dried in a test tube at 50‘c .

The dried extract was dissolved in 0.5N-hexane in HPLC apparatus (ISCO model 2350) HPLC and 205 UV/vis detectors with Hypersil HPLC column 250x̧4.6mm Bps180c5m.

Determination of organophosphorus pesticides:

The same method used to determine Organochlorine pesticides was used for extraction and clean up by acetonitrile partitioning. First, the cleanup process for the florisil column was completed by eluating the column with 200ml of 50petroleum ether /diethylether(v/v).The eluate was concentrated by rotator evaporator to create a dry film that was dissolved in 2 ml of n-hexane for HPLC determination.

<u>Results</u>

Table (1) Statistical analysis of Organochlorine residues (ppb, wet weight) in examined Tilapia Nilotica samples(n=45):

Pesticide residues	**Positive samples in Bahr Shibin(15)**		**Positive samples in El-Bagoria canal(15)**		**Positive samples in El-Menofi drainage(15)**	
	No.	**%**	**No.**	**%**	**No.**	**%**
DDT	**0**	**0%**	**7**	**46.6%**	**8**	**53.3%**
Aldrin	**0**	**0%**	**3**	**20%**	**4**	**26.6%**
Dieldrin	**0**	**0%**	**3**	**20%**	**5**	**33.3%**

Table (2) Mean residue levels of Organochlorine pesticides (ppb, wet weight) in examined *Tilapia* samples from EL-Bagoria canal and El-Menofi drainage

	DDT			**Aldrin**			**Dieldrin**		
	Min	**Max**	**Mean± St. error**	**Min**	**Max**	**St. error mean**	**Min**	**Max**	**Mean ±St. error**
El-Bagoria	**0.17**	**0.85**	**0.37±0.09**	**0.20**	**0.40**	**0.33±0.03**	**0.25**	**0.90**	**0.50±0.20**
EL-Menofy drainage	**0.15**	**0.76**	**0.34±0.07**	**0.29**	**0.65**	**0.40±0.08**	**0.15**	**0.85**	**0.40±0.13**

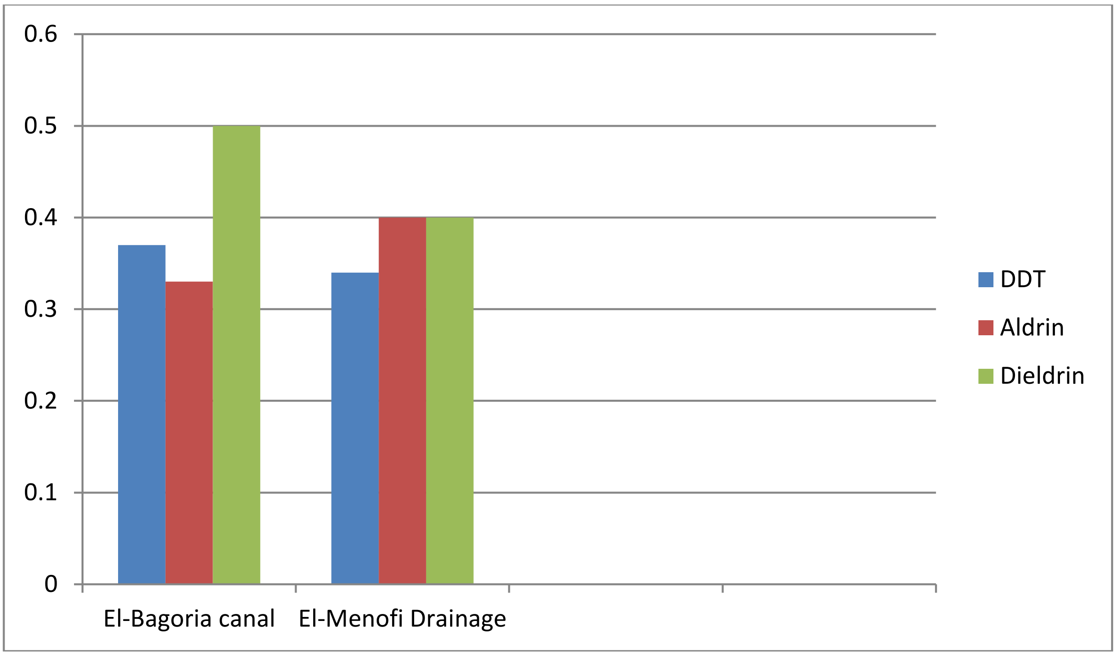

Figure (1): Mean residue levels of Organochlorine pesticides (ppb, wet weight) in examined *Tilapia Nilotica* samples from EL-Bagoria canal and El-Menofy drainage

Table (3) Statistical analysis of Organochlorine residues (ppb, wet weight) in examined Claris Lazera samples(n=45):

pesticides	Positive samples in Bahr Shibin(15)		Positive samples in El-Bagoria canal(15)		Positive samples in El-Menofy drainage(15)	
	No.	%	No.	%	No.	%
DDT	0	0%	5	33.3%	7	46.6%
Aldrin	0	0%	4	26.6%	5	33.3%
Dieldrin	0	0%	6	40%	7	46.6%

Table(4): Mean residue levels of Organochlorine pesticides (ppb, wet weight) in examined *Claris Lazera* samples from EL-Bagoria canal and El-Menofy drainage

	DDT			Aldrin			Dieldrin		
	Min	Max	Mean± St. error	Min	Max	mean± St. error	Min	Max	Mean ±St. error
El-Bagoria	0.25	0.55	0.40±0.06	0.12	0.43	0.25±0.07	0.18	0.67	0.34±0.08
EL-Menofy	0.10	0.48	0.27±0.05	0.19	0.55	0.30±0.07	0.18	0.96	0.48±0.10

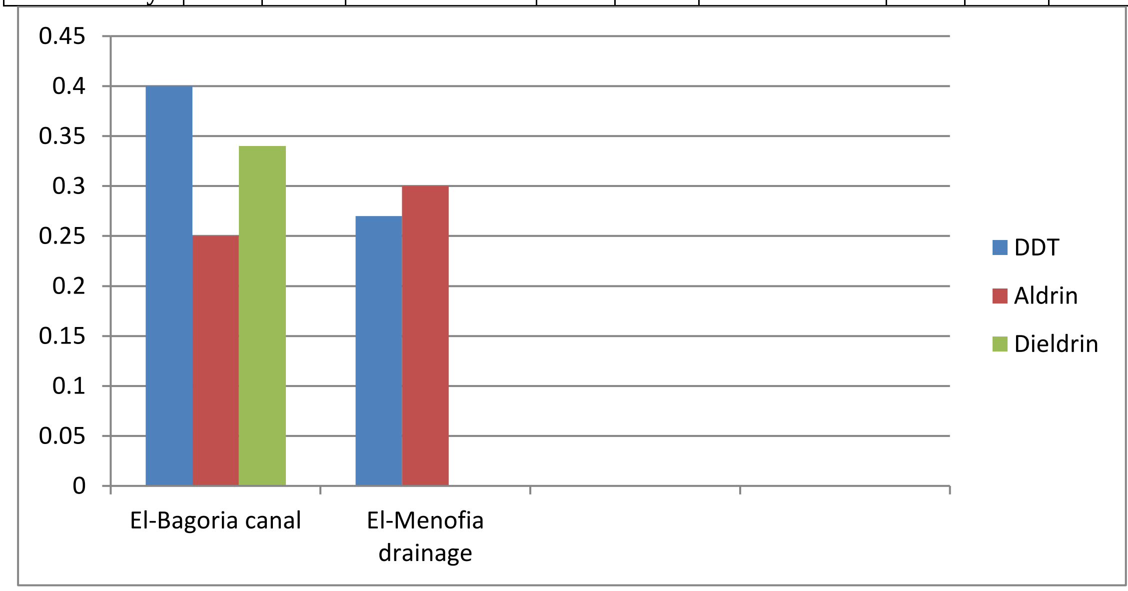

Figure (2): Mean residue levels of Organochlorine pesticides (ppb, wet weight) in examined *Claris* Lazera from EL-Bagoria canal and El-Menofy drainage

Table (5) Statistical analysis of organophosphorus residues (ppb, wet weight) in examined Tilapia Nilotica samples(n=45):

pesticides	Positive samples in Bahr Shibin(15)		Positive samples in El-Bagoria canal(15)		Positive samples in El-Menofi drainage(15)	
	No.	%	No.	%	No.	%
Diazinon	0	0%	0	0%	3	20%
Malathion	0	0%	2	13.3%	5	33.3%
Chlorpyrifos	0	0%	3	20%	4	26.6%

Table (6): Mean residue levels of Organophosphorus pesticides (ppb, wet weight) in examined *Tilapia Nilotica* from EL-Bagoria canal and El-Menofy drainage

	Diazinon				Malathion			chlorpyrifos		
	Min	Max	Mean	St. error	Min	Max	St. error mean±	Min	Max	Mean ±St. error
El-Bagoria	0	0	0.00	0.00	3.5	7.5	5.50±2.0	0.75	8.25	5.0±1.66
EL-Menofy	2.25	4.5	3.33	0.65	2.25	9.15	4.98±1.22	1.5	4.75	3.0±0.71

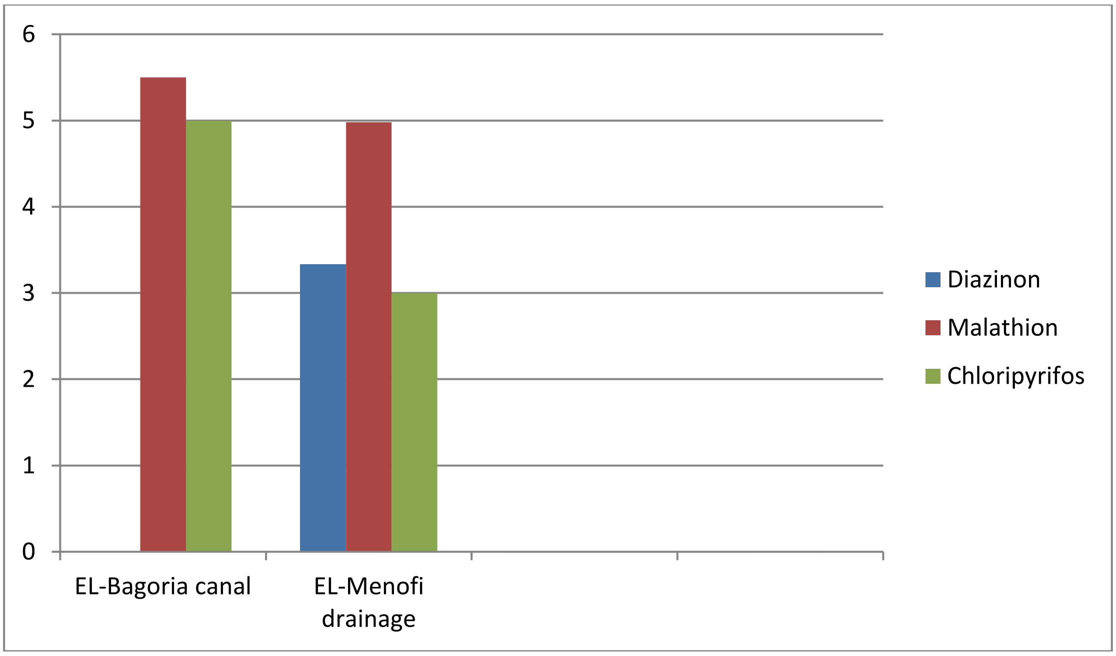

Figure (3): Mean residue levels of Organophosphorus pesticides (ppb, wet weight) in examined *Tilapia Nilotica* samples from EL-Bagoria canal and El-Menofy drainage

Table (7) Statistical analysis of organophosphorus residues (ppb, wet weight) in examined Claris Lazera samples(n=45):

Pesticide residues	Positive samples in Bahr Shibin(15)		Positive samples in El-Bagoria canal(15)		Positive samples in El-Menofy drainage(15)	
	No.	%	No.	%	No.	%
Diazinon	0	0%	0	0%	6	40%
Malathion	0	0%	0	0%	9	60%
chlorpyrifos	0	0%	0	0%	5	33.3%

Table (8): Mean residue levels of Organophosphorus pesticides (ppb, wet weight) in examined Claris Lazera samples from EL-Bagoria canal and El-Menofy drainage

	Diazinon			Malathion			Chlorpyrifos		
	Min	Max	Mean± St. error	Min	Max	St. error mean	Min	Max	Mean ±St. error
El-Bagoria	0	0	0.00±0.00	0	0	0.00±0.00	0	0	±0.00 0.00
EL-Menofy	2. 5	12	6.8±1.42	2.5	10	4.64±0.81	2	0.85	4.0±0.96

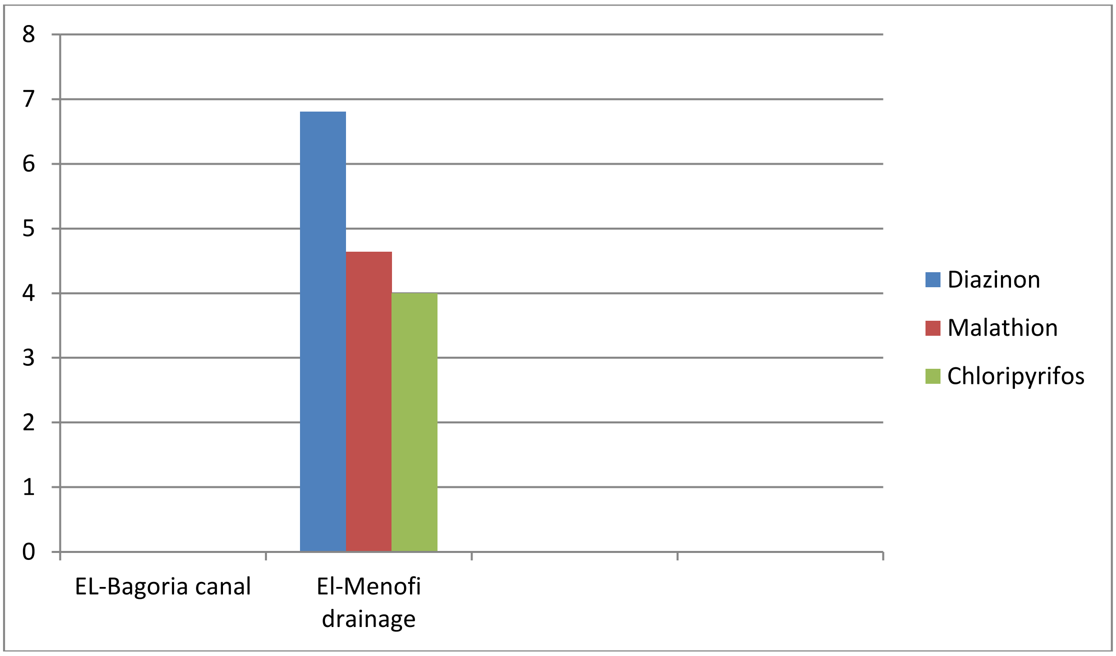

Figure (4): Mean residue levels of Organophosphorus pesticides (ppb, wet weight) in examined *Claris Lazera* samples from EL-Bagoria canal and El-Menofy drainage.

Discussion

Fish is vital to human economic development. They are significant as a source of food and a by-product, a disease controller ,source of money and employer.

One of the biggest pollutants in water resources, which are thought to be the natural habitat of fish, pesticides. .On the other hand fish may be exposed to pesticides indirectly directly by gills breathing. Therefore, it was crucial to analyze fish samples to determine the rate of pesticide in fish flesh.

The results in Table 1 revealed that Bahr Shibin is free from Organochlorine residues while DDT was higher in El-Bagoria canal 4.46٪ and in EL-Menofy drainage 53.3٪while incidence of aldrin in Tilapia Nilotica 20٪from EL-Bagoria canal and 26.6 ٪ from

EL-Menofi drainage and incidence of dieldrin was high from EL-Bagoria 20٪ and from EL-Menofy drainage was 33.3٪.

According to **Ralls and Corles, 1972,** a significant amount of materials used for crop protection and the management of disease – transmitting insects still contaminate soil, air and water. This is due to DDT and its transformation products in the environment.

The results in the table 2 and figure 1 revealed that Tilapia samples from EL-Bagoria canal had minimum concentration of DDT as Organochlorine pesticides with mean value 0.37±0.09, with mean value for aldrin was 0.33±0.03from EL-Bagoria canal and mean level of dieldrin was 0.50±0.20 while the collected samples from EL-Menofy drainage mean level of DDT was 0.34±0.07, mean level of aldrin was 0.65±0.40 and mean level of dieldrin was 0.40±0.13while in Claris Lazera samples from EL-Bagoria canal mean level of DDT 0.40±0.06, mean level of aldrin was 0.25±0.07 and mean level of dieldrin was 0.34±0.08 while from EL-Menofy drainage mean level of DDT was 0.27±0.05, mean level of aldrin was0.30±0.07 and mean level of dieldrin was 0.48±0.10.

The results in Table3 revealed that Bahr Shibin is free from Organochlorine residues while incidence of DDT in Claris Lazera was higher in El-Bagoria canal 33.3٪ and high also in Claris Lazera from EL-Menofy drainage 46.6٪ , incidence of aldrin was high in Tilapia Nilotica from EL-Bagoria canal 26.6٪ and also high in Claris Lazera from EL-Menofy drainage33.3٪and incidence of dieldrin was high in Claris Lazera from EL-Bagoria canal 40٪ and also high in Claris Lazera from EL-Menofy drainage 46.6٪ . The results in Table 5 revealed no diazinon in Tilapia Nilotica from EL-Bagoria canal while 13.3٪ and also high in Tilapia Nilotica from EL-Menofy drainage 33.3 ٪ and incidence of chlorpyrifos was high in Tilapia Nilotica from EL-Bagoria canal 20٪and high also in Tilapia Nilotica from el-Menofy drainage 26.6٪.

The results of DDT in Tilapia from EL-Bagoria canal and EL-Menofi drainage were lower than detected by **Botaro et al.(2011)**,**Khalifa et al. 2020)**and **Darko et al.(2008)**and also lower than that detected by**Sethuraman et al.(2013) .**

Mean value of aldrin in Tilapia was higher than that detected by **Ali et al. 2016** from Bahr EL-Banat.

Mean value of aldrin and dieldrin were greater than detected by **EL-Sayed et al. (2021)**.

The results of aldrin in Tilapia Nilotica from EL-Bagoria canal and EL-Menofy drainage were lower than that detected by **Mohamed et al. (2016)** but dieldrin in tilapia was higher than detected by **Mohamed et al. (2016).**

Mean value of aldrin and dieldrin is lower than that recorded by **Abbassy et al. (2021)**. Mean value of aldrin is higher than recorded by **EL-Sayed et al.(2021)**

The results of aldrin in Tilapia from EL-Bagoria canal were lower than that recorded by **Yahia and EL-Sharkawy (2014)**but in Tilapia Nilotica from EL-Menofy drainage were higher than that recorded by **Yahia and EL-Sharkawy (2014)**

Concerning dieldrin recorded in Tilapia Nilotica in EL-Bagoria canal and EL-Menofy drainage is higher than that recorded by **Botaro et al.(2011**)

Mean value of aldrin in Claris Lazera samples was lower than that recorded by **Ali et al. 2016** was while level of dieldrin was recorded by **Ali et al.2016** was higher than my investigation.

Mean value of aldrin and dieldrin in Claris Lazera were lower than that recorded by **Hassan et al. (2020)**

There were no diazinon, Malathion, chlorpyrifos in fish from recorded in Claris Lazera from Bahr Shibin

The results on the table 6 and figure 3 revealed that mean level of no diazinon in Tilapia Nilotica from EL-Bagoria while mean level of Malathion from EL-Bagoria canal was 5.50±2.0, mean level of chlorpyrifos was 5.0±1.66.while from EL-Menofy drainage , mean level of diazinon was 3.33±0.65, mean level of Malathion was 4.98±1.22 and mean level of chlorpyrifos was 3.0±0.71.

The results of diazinon in Tilapia from EL-Menofi drainage were higher than that recorded by **Ibigbami et al. (2016)**and **(Yahia and EL-Sharkawy2014**).

-The results of malathion in Tilapia Nilotica from EL-Bagoria canal and from EL-Menofy drainage were higher than that recorded by **Soumis et al.(2003)** and (**Yahia and EL-Sharkawy2014**).

The results of dimethoate in Tilapia Nilotica from EL-Menofy drainage were equal to that detected by **Soumis et al.(2003)** but in Tilapia Nilotica from EL-Bagoria canal were higher than that recorded by **Soumis et al.(2003)**and (**Yahia and EL-Sharkawy2014**).

The results of diazinon in Claris from EL-Menofy drainage were higher than that recorded by **Ibigbami et al. (2016)** and **Yahia and EL-Sharkawy2014**).

The results of Malathion in Claris Lazera from EL-Menofy drainage were higher than that recorded by **Soumis et al. (2003)** and (**Yahia and EL-Sharkawy2014**).

The results of chlorpyrifos in Claris from EL-Menofi drainage were higher than that recorded by **Soumis et al. (2003)** and (**Yahia and EL-Sharkawy2014**).

References:

[1] **Abbassy, M.A.; Khalifa, M.A.; Nassar, A.M., EL-Din, E.andSalim, Y.M.(2020):**Analysis of Organochlorine pesticides residues in fish from Edko Lake(North of Egypt)using eco-friendly method and their health implications for human. Toxicol.Res.5-9.

[2] **Abdel Gawaad, A.A. Shams EL-Din andAli,M.M.(1989):p**esticide residues and acid in rain water proc. of the 3rd world Conference on Environment and Health of pesticides. Ein-Shams Univ.Cairo,Egypt, December11-15.

[3] **Abou-Donia, M.A.(1990):** Specified deviced techniques for detecting fish contamination PhD Thesis , Fac. Agri. Ain Shams Uni.

[4] **Abou-Elamatem, M.M.; H.S. Massoud and A.H. El-Sebae(1979):**water pollution with organochlorine pesticide in Egyptian lacks. Egyptian German seminar on environmental protection from hazards of pesticides in collaboration with DAAAD. Alexandria University. J.A.O.A.C. 17(5):94-108.

[5] **Ali, F.H. ; Abdel –Atty , N. A. ; Ouf, J.A. and Abdel-Latif, A.M.(2016):** Organochlorine residues in fishes collected from different water sources in EL-Fayoyum Governorate .23(1):77-84.

[6] **AOAC1980:** Official methods of the Association Official Analytical Chemists Washington D.C.(29 pesticides)Bej.

[7] **Botaro, D. ; Torres, J.P.M.; Malm, O.; Rebelo, M.F.; Henkelmann, B. and Schramm, K.W.(2011):** Organochlorine pesticides residues in feed and muscle of farmed Nile tilapia from Brazilian fish farms. Food and Chemical Toxicology., 49: 2125–2130.

[8] **Darko,G.F.; Akoto, ,O. and Oppong, C.(2008):** Persistent Organochlorine pesticide residues in fish, sediments and waterfrom Lake Bosomtwi, Ghana,72(1):21-24.

[9] **Edris, M. A.1; Fatin Said Hassanien; Fahim A. Shaltout; Azza, H.ELbaba; Nairoz, M. Adel(2017 a):**Microbiological evaluation of some frozen and salted fish products in Egyptian markets.Benha Veterinary Medical Journal, 33(2): 317-328.

[10] **Edris, M. A.1; Fatin Said Hassanien; Fahim A. Shaltout; Azza, H.ELbaba; Nairoz, M. Adel(2017 b):**Microbiological evaluation of some frozen and salted fish products in Egyptianmarkets.Benha Veterinary Medical Journal, 33(2): 317-328.

[11] **EL-Dib, M.A. Badawy, M.I,(1985):**Organochlorine insecticides and PCBsin water ,sediment and fish from the Midirran sea. Bull Environ. Contam.Toxicolb34:116227.

[12] **EL-Gazzar, R.; Noweir, M.andShamy ,M.K.(1989):** Levels of some trace metals among workers exposed to a mixture of insecticides Proc. of 3rd world conference on Environmental and Health hazards of pesticides . Ein-Shams Univ. Cairo.Egypt , December 11-15.

[13] **EL-Sayed, A.M. ; Mohamed, H.A. and Sharkawy, A.A.(2021):** Persistent organochlorone pesticides in fresh Nile Tilapia fish from Assiut City , Egypt and their health effects on human. Alexandria Journal of Veterinary Sciences , 70(1):40-46.

[14] **EL-Sarnagawy , D. and Rizk A.(1978):** Estimation of Organophosphorus pesticide Malathion in fish tissue. Archiv fur lebensmittel hygiene24:104—106.

[15] **FAO/WHO1987:** Food standard programme , Codex AlimentariousCommision Room.

[16] **Goldman, L.R. , Smith, D.F.L; Neutra, ,R.R. and Kiger, K.W.(1990):** Pesticide food poisoning from contaminated water meloni In Clifornia, 11985, Arch. Environ..Health45,229 .

[17] **Hassan, M.A and Shaltout, F.A. (2004):** Comparative Study on Storage Stability of Beef, Chicken meat, and Fish at Chilling Temperature.Alex.J.Vet.Science, 20(21):21-30.

[18] **Hassan, M.A ;Shaltout, F.A. ; Maarouf , A.A. and El-Shafey, W.S.(2014):** Psychrotrophic bacteria in frozen fish with special reference to pseudomonas species .Benha Vet. Med.J.27 (1):78-83.

[19] **Hassan M.; Shaltout, F.A.;Nabila E. El-sheikh3, Naglaa M. Sakr(2019):**Assessment of histamine residues in smoked and salted fish. Benha Veterinary Medical Journal 37,2: 50-52.

[20] **Hassan, M.A. ; Ahmed, A.M; Marzouk, N.M, and Maky, M.(2020):** Detection of Organochlorine pesticides residues in Nile fish and its risks in Qena City .SNUInternational journal of Veterinary Sciences 3(1):51-65.

[21] **Ibigbami, O.A.; Aiyesanmi, A.F. ;Adeyeye, E.I.; Adebayo, A.O. and Aladesanwa, R.D.(2016):**Concentration and Potential Health Risks Associated with Organophosphorus Pesticides Residues in Fish from Three Rivers in Ekiti State, South-Western Nigeria. African Journal of Basic & Applied Sciences 8 (6): 324-331.

[22] **Khalifa, S.R,; Hassan, M.A. ; Amin, A.A. and Marzouk, N.M.(2020):**Assessment of Organochlorine pesticides residues in Tilapia Niloticus. Benha.Veterinary Medical Journal.82-87.

[23] **Pesticide Analytical Mannualvol. Ì Methods which detect Multiple Residues)1978):**U.S. Deponent of health and Human Services. Food and Drug Administration.

[24] **Mohammed, A.A.; Tharwat, A.E. and Khalifa (2016):** Estimation of Organochlorine pesticides and heavy metals residues in two species of mostly consumed fish in Sharkia Governorate , Egypt, Japanese Journal of Veterinary Research 64:supplement 2 :s233-241.

[25] **Neumann ,G.B.1988:** The occurrence and variation of Organochlorine pesticides residues detected in Australian live stock at slaughter Acta, Veternaria Scandinavsa 84:299.

[26] **Ralls, J.W. and Cortes, A. (1972):** Survey of food ingredient-DDT reaction under thermal processing conditions. J. Food Sci .37-76.

[27] **Saad M. Saad, Fahim A. Shaltout, Amal A. A. Farag and Hashim F. Mohammed(2022):**Organophosphorus Residues in Fish in Rural Areas. Journal of Progress in Engineering and Physical Science.1(1):27-31

[28] **Sethuraman, A.; Kiros, S.; and Tomass, Z.(2013):** Residues of organochlorine pesticides in fishs from the Mumbai West Coast of India. International Journal of Pure and Applied Zoology volume 1, issue 1, March 2013.

[29] **Shaltout, F.A. (2003):***Yersinia Enterocolitica* in some meat products and fish marketed at Benha city. The Third international conference Mansoura 29-30 April.

[30] Shaltout, F.A. and Hashim, M.F. (2002): Histamine in salted, Smoked and Canned Fish products. Benha Vet. Med.J.13 (1):1-11.

[31] **Shaltout, F.A. ;Hashim,M.F. and Elnahas,s.(2015):** Levels of some heavy metals in fish (tilapia nilotica and Claris lazera) at Menufia Governorate. Benha Vet. Med.J.29 (1):56-64.

[32] **Soumis, N.; Luctte, M.;Sampaio, D.; al-Media, D.C.; Giroux, D; Moras, S. and Pichet, P.(2003):** Prescence of organophosphate insecticides in fish of the Amazon River. ActaAmazonica33(2):325-338.

[33] **Yahia, D., and Elsharkawy, E.E.(2014):** Multi pesticide and PCB residues in Nile tilapia and catfish in Assiut City, Egypt. Science of the Total Environment., 466: 306–314 .