



Persistence of deltamethrin and diazinon in environment of dairy farm

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ABSTRACT

The present study was carried out to investigate the persistence of some pesticides (diazinon and deltamethrin) in water, feeds and milk. The obtained results illustrated that diazinon was persisted for longer time in water, feed and milk samples than deltamethrin, it disappears within 21st and 14th day after application in water and feed, respectively, while it disappears within 30th day after application in milk. Moreover, deltamethrin disappears within 7th day after application in feed and water, while in milk it disappears within 21st day after application. We concluded that diazinon and deltamethrin were persisted in milk for longer time than both feed and water. Pesticides contamination of milk and milk products may lead to acute or chronic toxicity for human being representing public health hazards through their cumulative effects.

Keywords: Diazinon, Deltamethrin, Persistence, Milk.

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(BVMJ-30(1): 254-259, 2016)

1. INTRODUCTION

Egypt is one of the largest users of pesticides in order to duplicate her animal and plant production power. Several pesticides contain noxious substances that persist in the environment for a long time. Pesticide residues may be resulted in environmental contamination as well as human health hazards (Latif et al., 2011). About 8.5 million kg of pesticides are used in non-agricultural uses, as livestock and pet insect, grain storage and turf protection that based on their low cost, broad spectrum effectiveness and multi-pest control capability (US EPA, 2002). Some pesticides are biodegradable, while others persist in the soils for longer times (Tariq et al., 2006). Pesticide residues have been detected in the vegetables and cereals (Parveen et al., 2005), and in various water sources (Saqib et al., 2005). In order to avoid the toxic health hazards, it is necessary to determine the levels of

pesticides in food of animal origin such as milk especially at spraying areas. Milk contamination by pesticides can also caused by their application to the cow's body, in the cow barns, or even in the milk processing areas (Bogialli et al., 2004). Moreover, the feed to milk transference of pesticides is influenced by quantity ingested, absorption, pesticide metabolism and excretion by animals in production. Thus, the best risk management tool is prevention of exposure, either through feed or from the environment, of the animals to these contaminants, as well as the application of the withdrawal time (Kan & Meijer, 2007). Detection of pesticide residues in milk of ruminants represents a public health hazard, since milk and dairy products are widely consumed by infants, children and adults throughout the world. In view of this, many countries have enacted regulations to set the permissible limits of such pesticide residues in milk and dairy product to protect the consumers (Tsiplakou et al., 2010).

This study was carried out to investigate the persistence of some pesticides (diazinon and deltamethrin) in water, feeds and milk.

2. MATERIAL AND METHODS

2.1. Sampling

Sixty nine water and feed samples were collected (24 of each) at the same day of spraying before and after application for each diazinon and deltamethrin, the amounts of sampling were varied from 0.36- 4.8 L and 120-600 gm for water and feed, respectively according to our need in the methods used for analysis. All the samples were stored throughout the experiment (30 day) at room temperature. Sampling was carried out at different intervals, 1st, 2nd, 3rd, 7th, 14th, 21st, and 30th after application (invitro). Water samples were collected from drinker in glass bottle, while feed samples (Corn-Drees-Silage-Soya-Bran-Linseed-Molasses-Hey-Grille feed- Berseem) collected from feed troughs. Forty-eight fresh milk samples were collected from dairy farm at the same day of spraying before and after application at different intervals as mentioned before (in vivo) in polyethylene bags. The milk analysis was in the same day of collection or kept frozen.

2.2. Standards

Standard of diazinon was obtained from GmbH (Augsburg, Germany), and deltamethrin (97% to 99%) was granted by Pak China.

2.3. Deltamethrin in feed water and milk

water samples were done with HPLC-UV by chromatograph equipped with UV detector according to Flavio et al., (1999), while for feed samples used HPLC-UV detector according to Boussahel et al., (2006). Deltamethrin detection in milk was conducted on HPLC system using Photodiode array (PDA) detector according to Darko and Acquah (2008).

2.4. Diazinon in water, feed and milk

The procedure of water samples was carried out by using gas chromatography method using flame photometric detector (FPD) according to Martinez Vedail et al., (2002), while for feeds the protocol of QuEChERS Mini-residue method for the analysis of diazinon concerning commodities with high fat content according to Anastassiades et al., (2003). Because there are a lot of modifications of the QuEChERS method published, the procedure followed is described in detail (QuEChERS, 2009). The detection of diazinon in milk was carried out by GC equipped with an electron capture detector according to Walorczyk (2008).

2.5. Statistical analysis

Statistical analysis of data was carried out using the SPSS Microsoft version 16.0.1. One-way ANOVA tests to check the significant difference (SPSS, 2004).

3. RESULTS

The obtained results in the table showed that the mean values of deltamethrin in water samples were 54.00 ± 17.92 , 30.67 ± 6.89 and 9.20 ± 3.60 $\mu\text{g/L}$, respectively in the 1st, 2nd and 3rd day after application, while the mean values of diazinon were 77.00 ± 25.56 , 73.91 ± 24.70 , 18.73 ± 6.73 , 6.20 ± 2.61 and 1.20 ± 0.40 $\mu\text{g/L}$, respectively in the 1st, 2nd, 3rd, 7th and 14th day after application. It is clear from the table that the mean values of deltamethrin in feed samples were 80.00 ± 26.57 , 44.23 ± 14.39 and 10.20 ± 3.30 $\mu\text{g/kg}$, respectively in the 1st, 2nd and 3rd day after application, while the mean values of diazinon were 84.51 ± 28.91 , 45.63 ± 14.57 , 17.33 ± 5.33 and 3.66 ± 1.65 $\mu\text{g/kg}$, respectively in the 1st, 2nd, 3rd and 7th day after application. The obtained results illustrated in the table showed that the mean values of deltamethrin in milk samples were 25.40 ± 8.13 , 13.47 ± 4.13 , 7.48 ± 2.19 and 0.32 ± 0.10 $\mu\text{g/kg}$, respectively in the 1st, 2nd, 3rd and 7th day after application, while the mean values of diazinon were 55.97 ± 18.36 , 45.07 ± 15.36 , 25.7 ± 8.36 ,

Table (1) The persistence of deltamethrin and diazinon in water, feed and milk in different dairy farms (n=144).

Pesticides	water ($\mu\text{g/L}$)		Feed ($\mu\text{g/kg}$)		Milk ($\mu\text{g/kg}$)			
	Mean \pm SE	% reduction	Mean \pm SE	% reduction	Mean \pm SE	% reduction		
Deltamethrin	Before application	ND	-	ND	-	0.22 \pm 0.07	-	
	After application	1 st day	54.00 \pm 17.92	-	80.00 \pm 26.57	-	25.40 \pm 8.13	-
		2 nd day	30.67 \pm 6.89	34.2%	44.23 \pm 14.39	44.7%	13.47 \pm 44.13	46.9%
		3 rd day	9.20 \pm 3.60	82.9%	10.20 \pm 3.30	87.3%	7.48 \pm 2.19	69.1%
		7 th day	ND	100%	ND	100%	0.32 \pm 0.10	98.7%
		14 th day	ND	-	ND	-	ND	100%
		21 st day	ND	-	ND	-	ND	-
		30 th day	ND	-	ND	-	ND	-
Diazinon	Before application	0.92 \pm 0.31	-	0.96 \pm 0.32	-	0.73 \pm 0.24	-	
	After application	1 st day	77.00 \pm 25.56	-	84.51 \pm 28.91	-	55.97 \pm 18.36	-
		2 nd day	73.91 \pm 24.70	5.1%	45.63 \pm 14.57	46%	45.07 \pm 15.36	19.5%
		3 rd day	18.73 \pm 6.73	75.6%	17.33 \pm 5.33	79.4%	25.7 \pm 8.36	54%
		7 th day	6.20 \pm 2.61	91.9%	3.66 \pm 1.65	95.7%	18.52 \pm 6.62	66.9%
		14 th day	1.20 \pm 0.40	98.4%	ND	100%	3.00 \pm 1.62	94.6%
		21 st day	ND	100%	ND	-	0.93 \pm 0.32	98.3%
		30 th day	ND	-	ND	-	ND	100%

18.52 \pm 6.62, 3.00 \pm 1.62 and 0.93 \pm 0.32 $\mu\text{g/kg}$, respectively in 1st, 2nd, 3rd, 7th, 14th and 21st day after application.

4. DISCUSSION

The results in the table showed that spraying process of deltamethrin cause contamination of drinking water and drinkers in a level higher than permissible limit, even after first few days of application and persist for several days but in very minute amounts. Deltamethrin was not detected in water samples within 7th day after application. The current findings agreed quite well, with those recorded by Thomson (1989). Moreover, Goodarzi et al., (2010) mentioned that after the releasing of deltamethrin into water, it adsorbed to suspended solids and sediment based, biodegradation may be expected in aqueous environments. Volatilization from water surfaces is expected to be an important fate process. It is clear from the table that

diazinon residue disappeared within 21st day after application. These findings were nearly similar to those obtained by Giddings (1996) and Shayeghi et al., (2001) who reported that rivers are contaminated with OP pesticideresidues (diazinon). Moreover, it persisted in environment at higher concentration than the allowable limits for 1 month after the spraying. Concerning to feed samples, the results clarified that during deltamethrin application in modern dairy farms, to eliminate ectoparasites on animals, it also caused contamination of feedstuff in feed troughs and storage room. Deltamethrin residues were not detected in feed samples within 7th day after application. The current findings agreed quite well, with those recorded by Haug and Hoffman (1990). On the other hand, Yu C et al., (2014) reported that the half-life of deltamethrin were 23-24 days on stored feeds in clean, dry and cooled area which not exposed to environmental factors. It is clear from the table that diazinon was not detected in feed samples collected at 14th

day after application. The obtained results came in accordance with those recorded by Currie *et al.*, (1990), Tavakol (2007) and Arjmandi *et al.*, (2010) who said that the highest level of diazinon was detected one day after the spraying of agriculture station in amount of 1.14 ppm, while at 1st and 2nd week after application the levels were decreased to 0.6636 and 0.048 ppm, respectively. Also, the amount of diazinon was not detected after one and two months after the spraying. On the other hand, Bondarenko and Gan (2004) found that the amounts of diazinon were detectable until the first month after the spraying phase. This may be attributed to high persistency of diazinon in the ambient environment. While, Beaton *et al.*, (2010) mentioned that accidents during filling spray equipment often result in contamination that are hazardous to human and livestock health. Residues can be up to 500 times higher than concentration caused from spray drift or indirect contamination. Moreover, Currie *et al.*, (1990) reported that diazinon is more persistent than other OP pesticides as it precipitated onto the floors, surface, drinkers and water troughs 4 hr (peaks) after application and lasted for 10 days. Concerning to milk samples, the results showed that deltamethrin descend in milk for several days after spraying not only from consumption of contaminated water and feed, but also from lack of precautions and absence of awareness. The residue of sprayed deltamethrin disappeared within 21st day after application. The current findings agreed quite well, with those recorded by Kan and Meijer (2007) and Yu C *et al.*, (2014). The current findings disagreed quite well, with those recorded by Akhtar *et al.*, (1992) who found that the levels of deltamethrin were 0.0095, 0.011, 0.0065, 0.0135, 0.002 and 0.01 mg/kg in milk samples collected in the 4th, 10th, 11th, 18th, 25th and 28th day respectively, from treated cows subcutaneously with 2ppm deltamethrin (2000µg/kg). The variation in persistence of pesticides may be attributed to type and concentration

of pesticides, source of feed and water as well as mode of pesticide application (Turi *et al.*, 2000). It is clear from the table that diazinon residue was not detected in milk samples within 30th day after application. The obtained results came in accordance with those recorded by Kabir *et al.*, (2008). Moreover, Meister (2000) found that diazinon may be stored in fats for two weeks, while application of diazinon to the skin may be resulted in passing residues to milk 24 hours after application. Our results concluded that diazinon was persisted in water, feed and milk for longer time than deltamethrin. However, deltamethrin rapid degradable pesticides, it may contaminate large number of collected samples that may be attributed to application without any precaution and without following the instructions and dose on the bottle during application. Moreover, both diazinon and deltamethrin were persisted in milk for longer time than in water and feed, this may be attributed to store in lipid inside dairy cows and excreted in milk according to fat %, milk yield and times of milking/day (Yu *et al.*, 2014).

From all of these, several precautions should be taken during pesticides application to minimize reaching of residues to animal body and milk which may contribute to public health hazards especially for children.

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