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Effect of some pyrethroids insecticides on the physical traits of albino rat (*Rattus norvegicus*: Berkenhout)

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Abstract
Study was conducted to ascertain the effect of various pyrethroid viz., Cypermethrin (@ 0, 130,150 and 200mg/kg), Deltamethrin (@ 0, 20,25 and 30 mg/kg), Permethrin (@ 0, 150, 250 and 350 mg/kg) and Lambda Cyhalothrin (@ 0, 30,50,and 70 mg/kg) on physical traits on same aged male albino rat (*Rattus norvegicus*) in research laboratory of Govt. College University, Faisalabad, Punjab, Pakistan under controlled conditions (25± 1ºC, 70 ± 5% RH, 12 h day: night regimes) during 2016 and 2017 following CRD replicated thrice. The observation regarding body weight, liver weight, kidney weight, relative liver weight, relative kidney weight (Physical traits). The results revealed that reduction in body weight and organ weight were observed in the application of some pyrethroids at all dose rates and post treatment intervals.

Keywords: pyrethroids, body weight, organ weight, physical traits, albino rat

Introduction
The most acute problem that the human beings are facing in 21st century is environmental pollution. There is a fair number of pollution causing agents that are disturbing the existence of human life on this planet. These pollutants have alarming effect on human health. The use of chemicals in the form of pyrethroids, pesticides, insecticides and fertilizers in the field of agriculture has increased environmental pollution and has created a number of health issues. The effect of these chemicals on the health of those people is more severe who are involved in the handling of these chemicals [8].

Pesticides have severe toxicity through the dermal and breathing passages and are not a skin sensitizer. Through oral passage, they are considered more fatal. Pyrethroids are not likely to be of stern toxicity for occupationally bare issues retaining good work practices and protection insurances [34]. The pesticides that are used may assimilate into the tissues of plants and food ingredients and may become the part of food chain and may gather at all trophic levels generation after generation by bio intensification [38]. Environmental pollution due to pesticides signifies one of the acute problems world-wide during the current years. The existence of these poisonous substances was noted in air, water, house dirt and in the tissues of no occupationally visible people, specifically in the adipose tissue, blood and urine [12]. The marketing of assortments of pyrethroids insecticides has developed very common in evolving countries and has given rise to intensification in the predominance of toxicity [22]. Ecological contaminants, comprising pesticides could have a key effect on the communal health such as life style, drugs, and toxins play significant part in the progression and/or precipitation of ailments like diabetes, hypertension, obesity, and cardiovascular ailments [11].

The elementary pyrethroid construction was adapted to upsurge its insecticidal strength and photostability however this also lead to changes in pyrethroid action in non-target species [41]. Acquaintance to pesticides by inhalation leads to hepatotoxicity and anemia and constant contact to pesticides exhausts may perhaps be poisonous and capable of instigating several organ poisonousness can be inferred to man [1]. Kidney and liver are amongst the utmost common chemical-affected tissues [21].

Cypermethrin is an artificial pyrethroid used as an insecticide in extensive merchantable agrarian uses as well as in costume merchandises for internal tenacities. It is observed in several domestic ant and cockroach killers, comprising Raid and ant chalk [31].

Deltamethrin, a kind II artificial pyrethroid, has headed to a extensive apprehension above the probable opposing effects on the health of human beings and display neurological [40] and behavior variations similar to Attention-Deficit/ Hyperactivity Disorder (ADHD) in human beings [6].

Permethrin belongs to kind I pyrethroid broadly used as an insecticide [46]. The marketable permethrin-containing pesticides are extensively used wood preservers and its efficiency in the control of termites, beats and parasites [30]. It is also used topically in the medicinal cure of scabies and ailments related with parasites and ticks [45]. Very regularly, it is used in numerous domestic, in its powdered form, in killing pests, like cockroaches. It is also used on agricultural crops, chiefly fruits and vegetables [19].

Lambda cyhalothrin being a third generation insecticide comprises of cyano group and is existing in a number of designs [25]. Because to its quick metabolism and secretion its poisonousness for mammal at present is fairly small, on the other hand it might produce harms in non-target species in future if applied indiscriminately [37]. Lambda cyhalothrin is used in vector control such as mosquito by straight spraying over water bodies [43]. Human and animals are visible openly to LCT by contact in work places or ultimately by its remains in foods [4].

Ibiangi (2013) carried out sub-chronic toxicity study to determine the effect of deltamethrin and ridomil, singly and in combination, on serum biochemical parameters in rats. No significant differences (P>0.05) were observed in body weight, and weights of liver. Patrick *et al*. (2014) determined the effect of sub-chronic exposure to Solignum, a permethrin-containing wood preservative showed a progressive increase in the body weight of rats in control whereas, rats treated with different concentrations decreased significantly (≤0.05) especially at the end of the second and fourth week as compared to control. On the other hand, there was a significant decrease in the relative liver weights of rats treated with 100 and 200 mg/kg BW Solignum while rats treated with 400 mg/kg BW showed a significant increase when compared with control. The relative weight of kidneys in experimental groups increased significantly when compared with control.

Madu [23] evaluated the teratogenic and embryotoxic effects of cypermethrin in 5% vegetable oil using albino rats which revealed reduced fetal weights and with ecchymosis particularly in higher doses. The extent of fetal death and resorptions observed were not statistically significant compared to controls. Desai [7] assessed the adverse effect of Deltamethrin (DM) on reproductive organs and fertility indices of male Swiss albino mice, *Mus musculus* which caused a significant reduction in body and organ weights, sperm count, sperm motility percent and sperm viability. Madiha [22] evaluated the individual and combined toxic effects of deltamethrin (DLM) and dimethoate (DM) on brain of adult male albino rats. At the end of the study (12 weeks) Body weight was evaluated which revealed that single DLM and DM exposure significantly had adverse effects on adult male Albino rats in the form of decrease in the body weight. Long-lasting effects in rats comprise reduced body weights, organ weight variations (liver, kidney, brain, heart and lung), abridged brain size, cell injury (neoplastic and histopathological lesions), tumors [18] and endocrine toxicity [20].

With this interpretation, the current analysis was aimed to study the effect of pyrethroids, cypermethrin, Deltamethrin, permethrin and Lambda cyhalothrin the dose-dependent physical trait in Albino rat (*Rattus norvegicus*) with the subsequent aims

- Physical traits
  - Body weight, Organ weight and Relative organ weight

Materials and Methods

The present study was designed to evaluate the toxicological effects of some pyrethroids (Cypermethrin, Deltamethrin, Permethrin and Lambda cyhalothrin) on physical traits in albino rats. All experimental work was done in research Laboratory at Department of zoology, Government college university Faisalabad, Pakistan.

The pyrethroids formulations

Commercial formulation of pyrethroids was used. It was in the form of emulsion and adequate dilutions were done in distilled water in order to reach different test concentrations (mg/kg). The test concentrations of pyrethroids were calculated from the percentage of active ingredient of commercial formulations (Cypermethrin 10% EC, Delatamethrin 15% EC, Permethrin 1.0% W/V and Lambda cyhalothrin 2.5% EC) of insecticides. Solutions were freshly made immediately before usage.

Animal Model

Total 120 healthy Albino rats of 3-4 weeks weighing (100g-190g) purchased from the animal house of GC University Faisalabad and university of agriculture, Faisalabad. Rats kept in animal house ventilated cages under standard lighting condition and natural day /night cycles after approval from the local ethical committee of GC University Faisalabad.

Experimental Design

The present study to evaluate the toxic effect of pyrethroids was conducted for 28 days on albino rats. Data were collected at every 7, 14 and 28 day. Before starting the experiment, body weight of all the albino rats were measured. Diet (poultry feed) mixed with olive oil and pyrethroid was given to albino rats on alternate days. Pyrethroids mix doses prepared as follows in Table. 1

Table 1: Pyrethroids with its LD50 Doses

S. No.	Pyrethroids Names	LD50 Doses	References
1	Cypermethrin	433mg/kg	[5, 10]
2	Deltamethrin	25mg/kg	[29]
3	Permethrin	430mg/kg	[30]
4	Lambd cyhalothrin	80mg/kg	[27]

One hundred and twenty albino rats were divided into five main and subgroups, in which each group contained eight (n=12) albino rats. These groups are following as:

Group I: Control group

Rats of this group were received water and food only during the whole study. No treatment was given to this group.

Group II: Treated with Cypermethrin
Three subgroups made for 100 mg (1/4th of LD50) CG1 as low dose, 150 mg CG2 as medium dose, 200 mg (two fold of low dose) CG3 as high dose were selected which was given by adding in feed.

Group III: Treated with Deltamethrin
In this group, three subgroups was made for the dosage which was contained 20 mg (1/4th of LD50) DG1 as low dose, 25 mg DG2 as medium dose, 30 mg DG3 as high dose selected by feeding.

Group IV: Treated with Permethrin
In this group, three subgroups was made for the dosage which was contained 150 mg (1/4th of LD50) PG1 as low dose, 250 mg PG2 as medium dose, 350 mg PG3 as high dose selected by feeding.

Group V: Treated with Lambda Cyhalothrin
In this group, three subgroups was made for the dosage which was contained 30 mg (1/4th of LD50) LG1 as low dose, 50 mg LG2 as medium dose, 70 mg LG3 as high dose selected by feeding.

Body, Organ and Relative Organ Weight
At every 7, 14 and 28 day, the liver and kidneys were carefully dissected out and recorded weighed in grams (absolute organ weight). The relative organ weight (Patrick C. K., 2014) of each animal was then calculated as follows:

$$\text{Relative organ weight} = \frac{\text{Absolute organ weight (g)}}{\text{Body weight of rat of sacrifice day (g)}} \text{ X } 100$$

Statistical analysis
Results were statistically analyzed by one-way analysis of variance (ANOVA), means were separated using Tuckey,s test at a significance level of 0.05. Mean comet scores of all groups was also analyzed by LSD to isolate significant difference. A value of $p < 0.05$ considered statistically significant.

Results
Body weight of Albino rat
Analyses of variance regarding the effect of some Pyrethroids at various doses and post treatment intervals on the body weight reveal that cypermethrin and lambda cyhalothrin showed significant difference between days, doses and in their interactions, whereas deltamethrin showed significant difference among post treatment intervals and in their interactions between intervals and dose rates. Conclusively, the application of Cypermethrin, Deltamethrin and Lambda cyhalothrin at various dose rates resulted in significant reduction in body weight of albino rat upto 28 days of post treatment interval, whereas permethrin showed adverse influence.

Table 2: Analysis of variance (mean squares) regarding the effect of pyrethroids at various doses (mg/kg) and post treatment intervals on the Body weight (mg) of Albino rat.

Source	d.f	Mean squares			
		Cypermethrin	Deltamethrin	Permethrin	L. Cyhalothrin
Dose	3	6304.333**	9124.185**	9714.593**	6924.519**
Days	2	577.000**	323.694ns	3110.583**	1728.861**
Days x Dose	6	346.333**	680.102*	251.843ns	359.046**
Error	24	72.500	206.306	138.083	61.944

NS = Non- significant; * = Significant at P≤0.05); ** = Significant at P≤0.01.

Table 2a: Means comparison of the data pertaining to the effect of pyrethroids at various doses and post treatment intervals on the body weight (mg) of Albino rat**.**

Days	7 day	14 day	28 day	Mean
Cypermethrin				
Control	131.67±7.26ab	131.67±9.28ab	153.67±4.48a	139.00±5.17A
D1 (130mg/kg)	114.67±4.91bc	100.00±1.15cd	99.33±1.76cd	104.67±2.94B
D2 (150 mg/kg)	104.00±4.51cd	82.33±4.10de	82.67±6.01de	89.67±4.35C
D3 (200mg/kg)	91.67±3.48cde	74.00±2.52e	68.33±3.28e	78.00±3.84D
Mean	110.50±4.96A	97.00±7.03B	101.00±9.91B	
Deltamethrin				
Control	118.33±4.41cde	131.67±7.26b-e	142.67±10.74bcd	130.89±5.29B
D1 (20mg/kg)	196.67±8.82a	169.67±11.84ab	152.00±14.57bc	172.78±8.83A
D2 (25mg/kg)	139.00±10.39bcd	128.00±6.11b-e	120.33±5.78cde	129.11±4.72B
D3 (30mg/kg)	102.67±2.19de	92.33±1.20e	90.00±4.73e	95.00±2.48C
Mean	131.33±6.85A	127.08±8.91A	137.42±12.23A	
Permethrin				
Control	118.33±4.41	131.67±7.26	142.67±10.74	130.89±5.29D
D1 (150mg/kg)	156.67±8.65	153.33±6.01	173.33±2.85	161.11±4.41C
D2 (250mg/kg)	172.67±5.90	183.67±4.67	210.00±5.86	188.78±6.18B
D3 (350mg/kg)	186.67±7.31	196.00±7.02	235.00±7.21	205.89±8.23A
Mean	161.92±6.91B	162.83±9.36B	190.25±11.04A	
L. cyhalothrin				
Control	118.33±4.41bc	131.67±7.26ab	142.67±10.74a	130.89±5.29A
D1 (30mg/kg)	108.67±0.88bcd	94.33±2.73d	94.67±2.73d	99.22±2.62B
D2 (50mg/kg)	99.33±0.67cd	71.00±4.04ef	67.67±2.85f	79.33±5.23C
D3 (70mg/kg)	91.00±1.15de	56.67±2.85f	54.67±3.18f	67.44±6.03D
Mean	107.67±4.85A	84.58±7.42B	90.42±10.32B	

Means sharing similar letter in a row or in a column within a cell are statistically non-significant at P = 0.05. Small letters represent comparison among interaction means and capital letters are used for overall mean.

Liver weight of Albino rat

The analyses of variance pertaining to the effect of some Pyrethroids at various doses and post treatment intervals on the liver of albino rat reveal significant difference among days, dose and in their interactions (Table 2). The means comparisons are presented in Table 2a. It is evident from the results that liver weight of Albino rat was increased on increasing the dose rates as well as post treatment intervals. From these results it was concluded that the application of cypermethrin, deltamethrin and permethrin resulted in an increasing trend on the liver weight of albino rat at all the post treatment intervals as well as doses. Whereas, lambda cyhalothrin showed decreasing trend in liver weight at all the post treatment intervals on increasing the dose rate.

Table 3: Analysis of variance (mean squares) regarding the effect of pyrethroids at various doses (mg/kg) and post treatment intervals on the Liver weight of Albino rat.

Source	d.f	Mean squares			
		Cypermethrin	Deltamethrin	Permethrin	L. Cyhalothrin
Dose	3	5.855**	3.724**	7.362**	6.249**
Days	2	3.961**	3.606**	4.792**	2.050**
Days x Dose	6	0.289**	0.275*	0.358**	0.444**
Error	24	0.049	0.075	0.059	0.088

NS = Non-significant; * = Significant at P≤0.05); ** = Significant at P≤0.01.

Table 3a: Means comparison of the data pertaining to the effect of pyrethroids at various doses and post treatment intervals on the liver weight (mg) of Albino rat.

Days	7 day	14 day	28 day	Mean
Cypermethrin				
Control	5.20±0.12f	5.30±0.17f	5.43±0.18f	5.31±0.09D
D1 (130mg/kg)	5.80±0.06ef	6.27±0.15de	7.10±0.12bc	6.39±0.20C
D2 (150mg/kg)	6.13±0.09de	6.73±0.12cd	7.67±0.15ab	6.84±0.23B
D3 (250mg/kg)	6.43±0.15de	7.10±0.12bc	7.93±0.09a	7.16±0.22A
Mean	5.89±0.15C	6.35±0.21B	7.03±0.30A	
Deltamethrin				
Control	5.20±0.20g	5.30±0.17fg	5.43±0.18fg	5.31±0.10C
D1 (20mg/kg)	5.47±0.12fg	5.87±0.09d-g	6.60±0.21bcd	5.98±0.18B
D2 (25mg/kg)	5.77±0.12efg	6.37±0.18cde	7.20±0.15ab	6.44±0.22A
D3 (30mg/kg)	6.03±0.09c-f	6.77±0.12bc	7.60±0.21a	6.80±0.24A
Mean	5.62±0.11C	6.08±0.18B	6.71±0.26A	
Permethrin				
Control	5.20±0.12g	5.30±0.17g	5.43±0.18g	5.31±0.09D
D1 (150mg/kg)	5.87±0.09fg	6.30±0.17ef	7.40±0.12bc	6.52±0.24C
D2 (250mg/kg)	6.30±0.12ef	6.90±0.12cde	7.90±0.06ab	7.03±0.24B
D3 (350mg/kg)	6.67±0.15de	7.20±0.20bcd	8.27±0.15a	7.38±0.25A
Mean	6.01±0.17C	6.43±0.23B	7.25±0.33A	
L. cyhalothrin				
Control	5.20±0.12ab	5.30±0.17a	5.43±0.18a	5.31±0.09A
D1 (30mg/kg)	4.67±0.20abc	4.30±0.15cd	3.87±0.09cde	4.28±0.14B
D2 (50mg/kg)	4.37±0.23bcd	3.73±0.09de	3.03±0.18ef	3.71±0.21C
D3 (70mg/kg)	4.20±0.26cd	3.27±0.13ef	2.80±0.15f	3.42±0.23C
Mean	4.61±0.15A	4.15±0.24B	3.78±0.32C	

Means sharing similar letter in a row or in a column within a cell are statistically non-significant at P = 0.05. Small letters represent comparison among interaction means and capital letters are used for overall mean.

Relative liver weight of albino rat

All the Pyrethroids showed significant effect on the relative liver weight (%) at various post treatment intervals, doses and in their interactions (Table 3). The means comparison of the same is shown in Table 3a. All the Pyrethroids explored significant increase in relative liver weight at all the doses and post treatment intervals. Increasing dose rate and post treatment intervals resulted in significant increase in relative liver weight except D1 of deltamethrin and D3 of permethrin which showed a little bit decreasing trend in relative liver weight at D1 of deltamethrin and D2 of cypermethrin at 28 days of post treatment interval, respectively.

Table 4: Analysis of variance (Mean squares) regarding the effect of pyrethroids at various doses (mg/kg) and post treatment intervals on the Relative liver weight (%) in Albino rat.

Source	d.f	Mean squares			
		Cypermethrin	Deltamethrin	Permethrin	L. Cyhalothrin
Dose	3	51.442**	24.284**	0.547**	2.123**
Days	2	18.331**	3.098**	0.218*	2.392**
Days x Dose	6	3.587**	1.644**	0.121*	0.188ns
Error	24	0.599	0.219	0.039	0.221

NS = Non- significant; * = Significant at P≤0.05); ** = Significant at P≤0.01.

Table 4a: Means comparison of the data pertaining to the effect of pyrethroids at various doses and post treatment intervals on the relative liver weight (mg) of Albino rat**.**

Days	7 day	14 day	28 day	Mean
Cypermethrin				
Control	3.55±0.20h	3.97±0.19gh	4.08±0.37fgh	3.86±0.16D
D1 (130mg/kg)	5.08±0.24e-h	6.27±0.19def	7.16±0.23cde	6.17±0.32C
D2 (150mg/kg)	5.92±0.28efg	8.23±0.54bcd	9.40±0.89abc	7.85±0.60B
D3 (200mg/kg)	7.05±0.38de	9.63±0.46ab	11.68±0.71a	9.45±0.72A
Mean	5.50±0.36C	7.05±0.65B	7.95±0.94A	
Deltamethrin				
Control	3.84±0.21de	3.97±0.19de	4.48±0.04de	4.10±0.13C
D1 (20mg/kg)	3.65±0.28de	3.49±0.24e	3.36±0.09e	3.50±0.12C
D2 (25mg/kg)	4.20±0.34de	4.99±0.14cd	6.00±0.20bc	5.06±0.29B
D3 (30mg/kg)	5.89±0.20c	7.33±0.23ab	8.51±0.62a	7.24±0.43A
Mean	4.42±0.28B	5.07±0.43A	5.43±0.63A	
Permethrin				
Control	3.84±0.21bcd	3.97±0.19a-d	4.48±0.04a	4.10±0.13A
D1 (150mg/kg)	3.76±0.16bcd	4.12±0.12abc	4.27±0.09ab	4.05±0.10A
D2 (250mg/kg)	3.65±0.07cd	3.76±0.10bcd	3.77±0.08bcd	3.73±0.04B
D3 (350mg/kg)	3.57±0.05cd	3.67±0.08cd	3.52±0.05d	3.59±0.04B
Mean	3.74±0.07B	4.01±0.10A	3.85±0.10AB	
L. Cyhalothrin				
Control	3.84±0.21	3.97±0.19	4.48±0.04	4.10±0.13C
D1 (30mg/kg)	4.09±0.12	4.30±0.20	4.58±0.30	4.32±0.13BC
D2 (50mg/kg)	4.40±0.23	4.48±0.09	5.31±0.43	4.73±0.20AB
D3 (70mg/kg)	4.62±0.31	4.94±0.03	6.04±0.56	5.20±0.28A
Mean	4.32±0.12B	5.10±0.25A	4.34±0.14B	

Means sharing similar letter in a row or in a column within a cell are statistically non-significant at P = 0.05. Small letters represent comparison among interaction means and capital letters are used for overall mean.

Kidney weight of albino rat

The results in brief revealed that the kidney weight of albino rat was increased on increasing dose rate as well as on increasing post treatment interval whereas, application of lambda cyhalothrin resulted in an adverse response as those of obtained in cypermethrin, deltamethrin and permethrin. It was concluded that increasing trend in kidney weight of albino rat was observed in the application of cypermethrin, deltamethrin and permethrin as the doses and interval were increased whereas, Lambda cyhalothrin showed adverse results.

Table 5: Analysis of variance (mean squares) regarding the effect of pyrethroids at various doses (mg/kg) and post treatment intervals on the Kidney weight of Albino rat.

Source	d.f	Mean squares			
		Cypermethrin	Deltamethrin	Permethrin	L. Cyhalothrin
Dose	3	6.549**	6.563**	5.325**	1.722**
Days	2	0.929**	3.583**	2.431**	0.352**
Days x Dose	6	0.218**	0.332**	0.277**	0.079**
Error	24	0.044	0.080	0.039	0.016

NS = Non- significant; * = Significant at P≤0.05); ** = Significant at P≤0.01.

Table 5a: Means comparison of the data pertaining to the effect of pyrethroids at various doses and post treatment intervals on the Kidney weight (mg) of Albino rat.

Days	7 day	14 day	28 day	Mean
Cypermethrin				
Control	1.63±0.09def	1.77±0.07cde	1.77±0.15cde	1.72±0.06C
D1 (130mg/kg)	1.07±0.07f	1.07±0.03f	1.20±0.06ef	1.11±0.04D
D2 (150mg/kg)	2.10±0.15cd	2.83±0.12ab	2.93±0.13ab	2.62±0.15B
D3 (200mg/kg)	2.37±0.22bc	3.17±0.09a	3.43±0.15a	2.99±0.18A
Mean	1.79±0.16B	2.24±0.24A	2.30±0.29A	
Deltamethrin				
Control	1.63±0.09g	1.77±0.07g	1.77±0.15g	1.72±0.06C
D1 (20mg/kg)	2.07±0.12fg	2.70±0.06def	3.30±0.31bcd	2.69±0.20B
D2 (25mg/kg)	2.43±0.24efg	3.53±0.09abc	4.00±0.15ab	3.32±0.25A
D3 (30mg/kg)	2.93±0.15cde	3.73±0.09abc	4.33±0.24a	3.67±0.22A
Mean	2.27±0.16C	2.93±0.24B	3.35±0.31A	
Permethrin				
Control	1.63±0.09f	1.77±0.07f	1.77±0.15f	1.72±0.06D
D1 (150mg/kg)	2.13±0.09ef	2.40±0.12de	2.87±0.12cd	2.47±0.12C
D2 (250mg/kg)	2.53±0.09de	2.93±0.09cd	3.83±0.09ab	3.10±0.20B
D3 (350mg/kg)	2.90±0.06cd	3.27±0.12bc	4.27±0.22a	3.48±0.22A
Mean	2.30±0.15C	2.59±0.18B	3.18±0.30A	

L. cyhalothrin				
Control	1.63±0.09ab	1.77±0.07a	1.77±0.15a	1.72±0.06A
D1 (30mg/kg)	1.33±0.03bc	1.10±0.06cde	0.90±0.06def	1.11±0.07B
D2 (50mg/kg)	1.13±0.03cd	0.90±0.06def	0.63±0.03fg	0.89±0.08C
D3 (70mg/kg)	1.00±0.00c-f	0.73±0.09efg	0.43±0.09g	0.72±0.09D
Mean	1.28±0.08A	1.13±0.12B	0.93±0.16C	

Means sharing similar letter in a row or in a column within a cell are statistically non-significant at P = 0.05. Small letters represent comparison among interaction means and capital letters are used for overall mean.

Relative kidney weight of albino rat

The results pertaining to the effect of Pyrethroids at various doses and post treatment intervals on the relative kidney weight are shown in Table 5 and 5a. Conclusively, relative kidney weight was increased on increasing post treatment intervals as well as dose of cypermethrin, deltamethrin and permethrin whereas, decreasing trend in relative kidney weight was observed with lambda cyhalothrin on increasing dose rate as well as post treatment interval.

Table 6: Analysis of variance (mean squares) regarding the effect of pyrethroids at various doses (mg/kg) and post treatment intervals on the relative kidney weight (%) in Albino rat.

Source	d.f	Mean squares			
		Cypermethrin	**Deltamethrin**	**Permethrin**	**L. Cyhalothrin**
Dose	3	18.015**	12.692**	0.212**	0.122*
Days	2	3.697**	2.998**	0.175**	0.371**
Days x Dose	6	1.150**	0.700**	0.034*	0.040ns
Error	24	0.189	0.115	0.011	0.029

NS = Non-significant; * = Significant at P≤0.05); ** = Significant at P≤0.01.

Table 6a: Means comparison of the data pertaining to the effect of pyrethroids at various doses and post treatment intervals on the relative kidney weight (mg) of Albino rat.

Days	7 day	14 day	28 day	Mean
Cypermethrin				
Control	1.16±0.13e	1.24±0.01e	1.36±0.12de	1.25±0.06C
D1 (130mg/kg)	0.93±0.06e	1.08±0.05e	1.20±0.07e	1.07±0.05C
D2 (150mg/kg)	2.03±0.20de	3.47±0.31bc	3.61±0.45bc	3.04±0.30B
D3 (200mg/kg)	2.60±0.33cd	4.30±0.26ab	5.07±0.45a	3.99±0.40A
Mean	1.70±0.21B	2.58±0.41A	2.73±0.53A	
Deltamethrin				
Control	1.24±0.01d	1.26±0.16d	1.49±0.04d	1.33±0.06C
D1 (20mg/kg)	1.37±0.05d	1.61±0.10d	1.68±0.14d	1.55±0.07C
D2 (25mg/kg)	1.76±0.18d	2.77±0.08c	3.34±0.17bc	2.62±0.24B
D3 (30mg/kg)	2.86±0.17c	4.05±0.14ab	4.87±0.53a	3.93±0.34A
Mean	1.81±0.20B	2.48±0.31A	2.79±0.45A	
Permethrin				
Control	1.24±0.01d	1.26±0.16cd	1.49±0.04bcd	1.33±0.06C
D1 (150mg/kg)	1.36±0.04bcd	1.56±0.02abc	1.66±0.09ab	1.53±0.05B
D2 (250mg/kg)	1.47±0.03bcd	1.60±0.02ab	1.83±0.01a	1.63±0.05AB
D3 (350mg/kg)	1.56±0.03abc	1.67±0.04ab	1.81±0.04a	1.68±0.04A
Mean	1.41±0.04B	1.58±0.02A	1.64±0.08A	
L. cyhalothrin				
Control	1.24±0.01	1.26±0.16	1.49±0.04	1.33±0.06A
D1 (30mg/kg)	1.23±0.02	1.17±0.06	0.95±0.04	1.11±0.05AB
D2 (50mg/kg)	1.14±0.04	1.28±0.13	0.94±0.05	1.12±0.06AB
D3 (70mg/kg)	1.10±0.01	1.36±0.22	0.76±0.13	1.07±0.11B
Mean	1.18±0.02A	1.33±0.07A	0.98±0.07B	

Means sharing similar letter in a row or in a column within a cell are statistically non-significant at P = 0.05. Small letters represent comparison among interaction means and capital letters are used for overall mean.

Discussion

Cypermethrin exposure resulted in body weight reduction in treated albino rats. The decrease in bodyweight following cypermethrin administration was in accordance with reports on type II pyrethroid synthetic insecticides [7, 9, 35, 39] and some other pesticide exposure. This decrease in the body weight after cypermethrin administration was due to reduced dietary intake and consequently reduced energy intake. Previous findings showed an increase in body weight and weight gain of pregnant rats exposed to this pesticide in comparison to control none exposed pregnant rats [18].

The findings i.e. Loss of body weight, soft faeces, frequent diarrhea and occasional death were the most prominent clinical signs of cypermethrin poisoning in Wister rats corroborate nicely with [2, 3, 16, 26]. On the other hand, in sub-acute toxicity studies, no change in body weight was observed in Cypermethrin administered rats [36, 44]. Liver and kidney relative weights in treated albino rats were found different to those of control rats.

Chronic administration of pesticides has been reported to lead to significant reduction in body weight of animals [14]. Even though this was not the case in this study, the control animals

in rats had higher body weight than the pesticide treated ones, at the end of the treatment period. The probable reason for the increase in the weight of kidneys may be congestion of vessel and lymphocytic infiltration [15]. Other investigations have reported the reduction in body weight and change in relative organs weights in cypermethrin treated rats [13, 35].

Findings from this study revealed that oral ingestion of Permethrin-containing feeds was associated with increase in body, liver and kidney weights in comparison with animals fed on normal diet throughout the experiment. This assessment was accordance with Omotoso, *et al*., 2014. Changes in body weight gain and internal organ weights reflect toxicity after exposure to toxic substances [42]. Body weight changes have been used as markers of adverse effects of chemicals especially if the body weight loss is more than 10% of the initial body [28, 29, 33].

The reduction in body weight in rats exposed to lambda cyhalothrin could be either due to reduced daily feed intake or disturbances in level of metabolic hormones [4] subsequently resulted into decreased feed intake ultimately leading to significant reduction in body weight. In our study, a decrease in body weight and average feed intake were observed for rats treated with a high dose of Lambda cyhalothrin compared with control rats. Similarly, a significant decrease in the absolute and relative weights of liver and kidney was observed. These results were consistent with previous studies observed in rats expose to various pyrethroids and Lambda cyhalothrin administered orally to rats has also resulted in reduced body weight gain in both male and female rats [32, 17, 24].

Conclusion

So we recommended, improving working condition. Restriction of unlimited use of pyrethroid insecticides especially at home and agricultural purposes. Further researches are needed to evaluate pyrethroids effect on large sample to obtain detailed information about the exposure route, pathways, other mechanisms of toxicity and other health hazards.

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