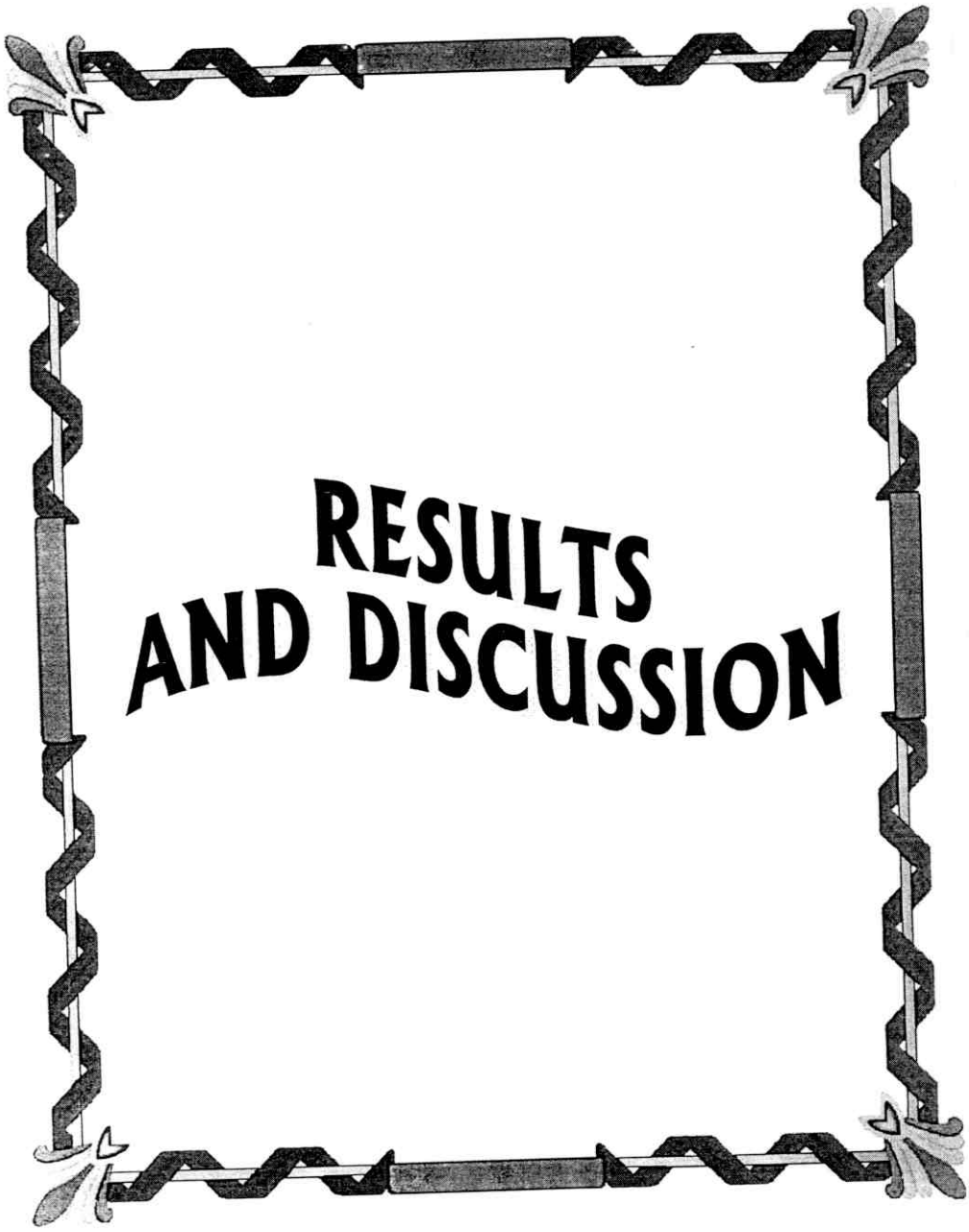

RESULTS
AND DISCUSSION

RESULTS AND DISCUSSION

1- Acute oral toxicity determinations of certain rodenticides:-

LD_{30}, LD_{50} and LD_{90} for Brodifacoum, Chlorophacinone and Warfarin were detected to the albino Norway rat, *R. norvegicus* and *Mus musculus* on the males and females which were fed on either (maize and wheat) or vegetables for two weeks.

1-A-Brodifaoum toxicity on albino rat, *R. norvegicus*:-

Serial doses of Brodifacoum 1.04, 0.52, 0.26, 0.13 and 0.065 mg/kg, body were used for both and the two types of food.

In case of maize and wheat fed. The corresponding mortality for these doses was 100, 75, 63, 48 and 30% for males, but it was 87, 62, 46, 28 and 18% in females doting 28 days from treatments. While it was 100, 90, 76, 53 and 18% in males, but it was 100, 82, 61, 46 and 31% in females which were fed on vegetables, at the previous doses of Brodifacoum, respectively.

Data present in Table (1) showed that the LD_{30}, LD_{50} and LD_{90} of Brodifacoum in males which were fed on maize and wheat were 0.11, 0.234 and 1.64 mg/ kg b.w. while in females were 0.260, 0.354 and 2.70 mg/ kg b.w. that the LD_{30}, LD_{50} and

LD_{90} of Brodifacoum in males which were fed on vegetables were 0.13, 0.225 and 0.95 mg/ kg but they were 0.12, 0.231 and 1.25 mg/ kg body weight respectively Table (2).

1-B- Brodifacoum toxicity on albino rat, *Mus musculus* :-

Serial doses of Brodifacoum 1.6, 0.8, 0.4, 0.2 and 0.1 mg/ kg b.w. were used for both sexes and for the two types of food. The corresponding mortality in males which were fed on maize and wheat was 100, 89, 65, 47 and 34%, but it was 100, 84, 65, 40 and 28% in females. vegetables food caused mortality 97, 82, 67, 52 and 41% in males, while it was 95, 82, 69, 53 and 37% in females respectively.

Data recorded in Table (3) detected showed that the LD_{30}, LD_{50} and LD_{90} of Brodifacoum in males which were fed on vegetables, were 0.235, 0.46 and 2.385 mg/ kg b.w. In females they were 0.284, 0.556 and 2.872 mg/ kg b.w., also, they were 0.175, 0.407 and 3.018 mg/ kg b.w. in males which were fed on maize and wheat while they were 0.184, 0.417 and 3.273 mg/ kg b.w. in females respectively Table (4).

2-A-Chlorophacinone toxicity on albino rat, *R. norvegicus* :-

serial doses of Chlorophacinone 82, 46, 20.5, 10.25 and 5.25 mg/ kg were tested for both sexes and for the two types of food. The corresponding mortality in maize and wheat fed was 100, 80, 65, 40 and 20% in males, but it was 100, 80, 67, 33 and 0.0% in females, while it was 100, 76, 60, 40 and 21% in males

which were fed on vegetables but they were 100, 78, 63, 42 and 20% in females respectively.

The LD_{30}, LD_{50} and LD_{90} which tabulated in Table (1) were 6.87, 12.805 and 58.61 mg/ kg b.w. in males , but they were 7.18, 16.043 and 114.84 in females which were fed on maize and wheat. While they were 13.33, 24.532 and 108.88 mg/ kg b.w. in males, but they were 14.56, 26.523 and 113.72 mg/ kg b.w. in females which they fed on vegetables, respectively.

2-B-Chlorophacinone toxicity on albino rat, *Mus musculus*:-

Serial doses of Chlorophacinone 90, 45, 22.5, 11.25 and 5.625 mg/ kg b.w. The corresponding mortality in males which were fed on vegetables, was 100, 85, 71, 48 and 36%, but in females was 100, 81, 68, 49 and 34%, while it was 95, 85, 72, 56 and 39% in males which were fed on maize and wheat while were the % mortality was 97, 76, 60, 53 and 46% in females which fed on maize and wheat respectively.

It is cleared from Table (3) that the LD_{30}, LD_{50} and LD_{90} were 7.932, 22.39 and 178.832 mg/ kg b.w. in males which were fed on vegetables, but they were 8.155, 22.677 and 264.142 mg/kg b.w. in females, while in case of maize and wheat they were 8.401, 20.312, and 175.711 in males, but they were 8.796, 21.538 and 215.299 mg/ kg b.w. in females, respectively Table (4).

3-A-Warfarin toxicity on albino rat, *R. norvegicus* :-

Serial doses of Warfarin 744, 372, 186, 93 and 46.5 mg/ kg b.w. were applies on both sexes and two types of food. The corresponding mortality was 100, 78, 56, 32 and 81% in males, but it was 100, 78, 52, 40 and 30% in females which were fed on maize and wheat. While it was 79, 62, 40, 19 and 0.0% in males, but it was 86, 71, 47, 28 and 0.0% in females which were fed on vegetables respectively.

Data illustrated in Table (1) showed the LD_{30}, LD_{50} and LD_{90} of Warfarin they were 48.14, 151.194 and 633.1 mg/ kg b.w. in males, but they were 85.29, 196.75 and 1517.28 mg/ kg b.w. in females which were fed on maize and wheat. While those were 146.87, 333.025 and 2483.03 mg/ kg b.w. in males, but in case of females they were 210.59, 435.945 and 2583.63 mg/ kg b.w. in females which were fed on vegetables respectively Table (2).

3-B-Warfarin toxicity on albino rat, *Mus musculus*:-

Serial doses of Warfarin 1496, 748, 374, 187 and 93.5 mg/ kg b.w. were assayed on both sexes and on the two types of food. The corresponding mortality was 100, 80, 73, 45 and 24% in males, but it was 100, 80, 63, 41 and 26% in females which were fed on vegetables. In maize and wheat feeding it was 87, 75, 63, 51 and 39% in males, while it was 90, 80, 72, 48 and 34% in females, respectively.

From Table (3) the LD_{30}, LD_{50} and LD_{90} were 257.811, 481.56 and 2217.223 in males, but they were 266.207, 489.575 and 2170.123 mg/kg b.w. in females, which were fed on vegetables respectively, while in maize and wheat feeding, they were 133.832, 380.419 and 4887.439 mg/ kg b.w. in males while they were 175.507, 407.894 and 5203.665 in females, respectively.

The obtained data illustrated in Tables (4) showed that in the three rodenticides, the males are more sensitive than females in all doses used and for the two types of food at LD_{30}, LD_{50} and LD_{90} . The LD_{30}, LD_{50} were higher in case of vegetables feeding than maize and wheat in both. Also, the data reveled that the LD_{30}, LD_{50} were higher in case of vegetables feeding than in case of maize and wheat feeding in both sexes and for the both species in the three tested rodenticides sexes and species in the three rodenticides use Generally, results undicated that. Brodifacoum was the most effective followed by Chlorophacinone and Warfarin in both sexes for the two rats and on the types of food. These results agree with several authors e.i, **Bull, 1976** who evaluated the acute oral single dose LD_{50} value to albino Norway rats *R. norvegicus* when treated with Warfarin was 186.0 mg/ kg. **Thonison, 1976** found the LD_{50} was 6.26 mg/ kg for Chlorophacinone, while, **Marsh *et. al.*, 1980** determined the LD_{50} was 180 mg/ kg for Warfarin on the previous rat. **Mathur and Prakash, 1981** calculated the LD_{50} at *R. rattus* to Brodifacoum were 0.73 and 0.65 mg/ kg for males and females respectively, **Johnson and Scott, 1986** evaluated the LD_{50} of *R. norvegicus* was 0.26 mg/ kg for Brodifacoum and

Abo-Elkear, 1993 found the LD_{50} value of Brodifacoum was 0.42 mg/ kg for *R. rattus* **Hagan (1953)** found the LD_{50} on *Mus musculus* for Warfarin was 374.0 mg/ kg b.w. while Red fern and **Hadler (1976)** evaluated the LD_{50} of WBA 8119 was 0.40 mg/ kg b.w. on *Mus musculus*. **Dubock (1979)** found the LD_{50} of Brodifacoum ranged between 0.021-0.050 mg/ kg b.w. on *Mus musculus*

Table (1): Effect of three anticoagulant rodenticides at different doses against both sexes of albino Norway rat, *R. norvegicus* fed on maize and wheat.

Rodenticides	Sex	LD_{30} mg/kg	LD_{50} mg/kg	LD_{90} mg/kg
Brodifacoum	Male	0.11 (0.07 – 0.13)	0.234 (0.17 – 0.3)	1.64 (1.33 – 2.74)
	Female	0.260 (0.98 – 0.21)	0.354 (0.3 – 0.42)	2.70 (2.1 – 3.9)
Chlorophacinone	Male	6.87 (4.44 – 8.38)	12.805 (09.24 – 16.74)	58.61 (49.99 – 100.46)
	Female	7.18 (06.65 – 8.87)	16.043 (016.15 – 21.44)	114.84 (114.44 – 459.7)
Warfarin	Male	84.14 (65.76 – 100.14)	151.194 (113.62 – 183.05)	633.1 (531.12 – 870.28)
	Female	85.29 (38.69 – 110.52)	196.75 (113.52 – 307.77)	1517.28 (1363.93–4344.69)

Table (2): **Effect of three anticoagulant rodenticides at different doses against both sexes of albino Norway rat, *R. norvegicus* fed on vegetables.**

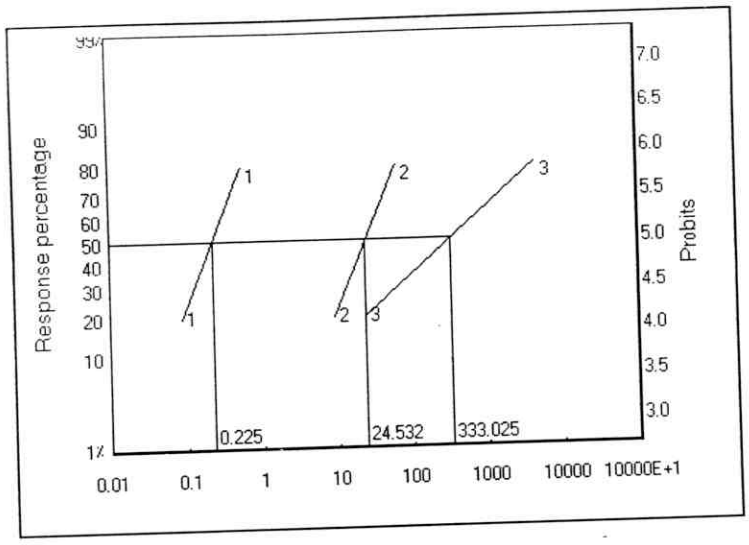
Rodenticides	Sex	LD_{30} mg/kg	LD_{50} mg/kg	LD_{90} mg/kg
Brodifacoum	Male	0.13 (0.095 – 0.15)	0.225 (0.18 – 0.27)	0.95 (0.8 – 1.27)
	Female	0.12 (0.095 – 0.14)	0.231 (0.2 – 0.27)	1.25 (1.07 – 1.58)
Chlorophacinone	Male	13.33 (10.11 – 15.75)	24.532 (19.71 – 29.76)	108.99 (93.06 – 152.63)
	Female	14.56 (12.28 – 16.64)	26.523 (23.03 – 30.07)	113.72 (98.06 – 139.6)
Warfarin	Male	146.87 (89.75 – 180.52)	333.025 (238.31 – 436.01)	2483.03 (2058.87 – 4735.96)
	Female	210.59 (165.56 – 249.9)	435.945 (366.7 – 515.51)	2583.63 (2059.85– 3759.993)

Table (3): Effect of three anticoagulant rodenticides at different doses against both sexes of albino *Mus musculus*, fed on vegetables.

Rodenticides	Sex	LD_{30} mg/kg	LD_{50} mg/kg	LD_{90} mg/kg
Brodifacoum	Male	0.235 (0.0203 – 0.265)	0.46 (0.419 – 0.502)	2.385 (2.081 – 2.8)
	Female	0.284 (0.249 – 0.319)	0.556 (0.509 – 0.605)	2.872 (2.485 – 3.409)
Chlorophacinone	Male	7.932 (5.871 – 10.451)	22.39 (15.652 – 24.63)	178.822 (152.634– 243.673)
	Female	8.155 (0.249 – 0.319)	22.677 (0.249 – 0.319)	264.142 (0.249 – 0.319)
Warfarin	Male	257.811 (228.767– 286.329)	481.65 (443.286–520.602)	2217.223 (1962.441– 2553.108)
	Female	266.207 (238.393–293.508)	489.575 (453.059–526.966)	2170.123 (1929.381– 2484.256)

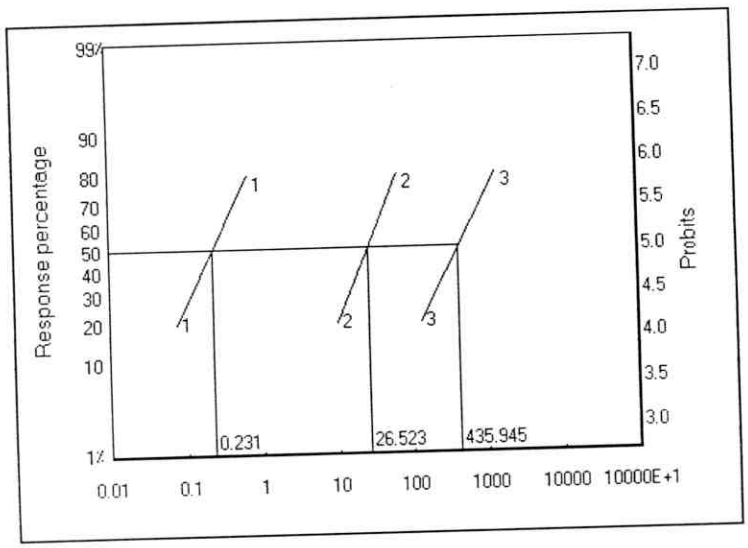
Table (4): Effect of three anticoagulant rodenticides at different doses against both sexes of albino *Mus musculus*, fed on maize and wheat.

Rodenticides	Sex	LD_{30} mg/kg	LD_{50} mg/kg	LD_{90} mg/kg
Brodifacoum	Male	0.175 (0.138 – 0.212)	0.407 (0.353 – 0.461)	3.018 (2.694 – 1.364)
	Female	0.184 (0.151 – 0.217)	0.417 (0.368 – 0.465)	3.273 (2.605 – 3.75)
Chlorophacinone	Male	8.401 (5.795 – 10.340)	20.312 (15.593 – 24.54)	175.711 (143.847 – 246.686)
	Female	8.796 (5.794 – 10.429)	21.538 (16.716 – 25.986)	215.299 (173.674 – 310.187)
Warfarin	Male	133.832 (102.079– 166.244)	380.419 (326.773– 434.055)	4887.439 (3832.691– 6635.211)
	Female	175.507 (144.789– 206.207)	407.894 (362.075– 453.979)	5203.665 (2695.088– 3941.982)



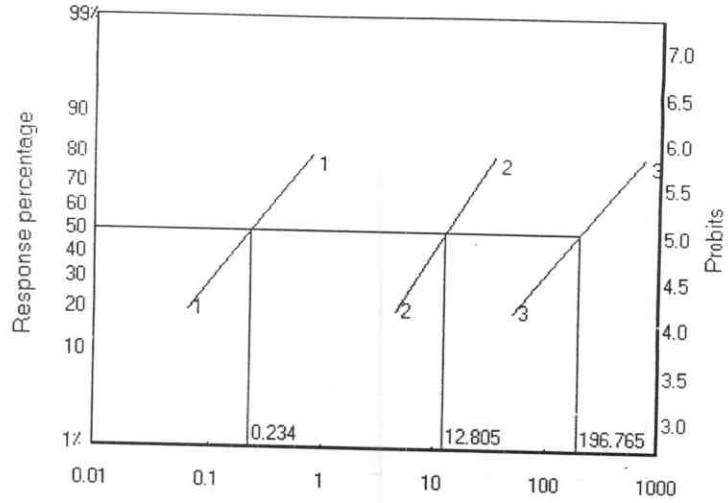
1- Brodifacoum 2- Chlorophacinone 3- Warfarin

Fig.(1): Log doses probit lines showing response of male of albino Norway rat *R. norvegicus* treated with Warfarin, Chlorophacinon and Brodifacoum fed on vegetables.



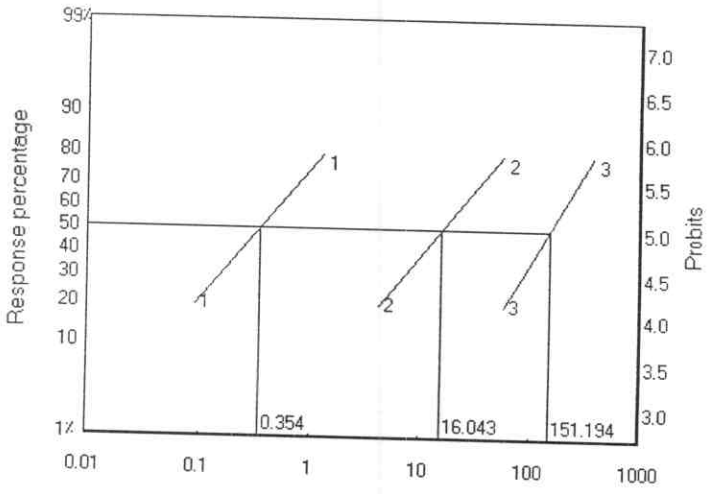
1- Brodifacoum 2- Chlorophacinone 3- Warfarin

Fig.(2): Log doses probit lines showing response of female of albino Norway rat *R. norvegicus* treated with Warfarin, Chlorophacinon and Brodifacoum fed on vegetables.



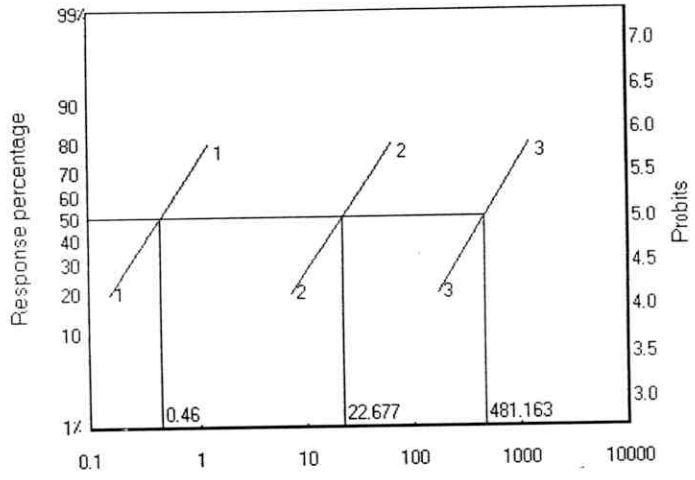
1- Brodifacoum 2- Chlorophacinone 3- Warfarin

Fig.(3): Log doses probit lines showing response of male of albino Norway rat *R. norvegicus* treated with Warfarin, Chlorophacinon and Brodifacoum fed on maize and wheat.



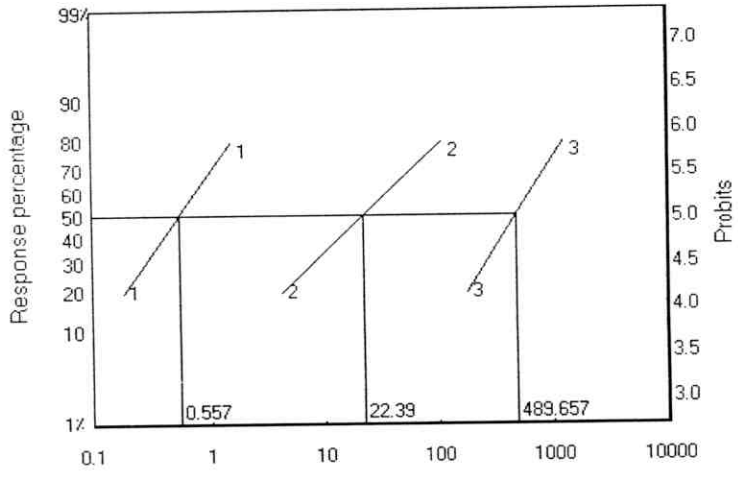
1- Brodofacum 2- Chlorophathnon 3- Warfarin

Fig.(4): Log doses probit lines showing response of female of albino Norway rat *R. norvegicus* treated with Warfarin, Chlorophacinon and Brodifacoum fed on maize and wheat.



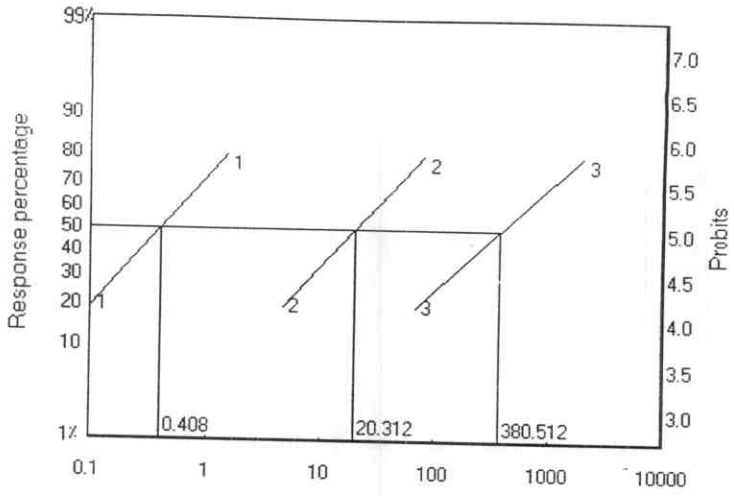
1 Brodofacum 2- Chlorophacinone 3- Warfarin

Fig.(5): Log doses probit lines showing response of male of albino house mouse *Mus musculus* treated with Warfarin, Chlorophacinon and Brodifacoum fed on vegetables.



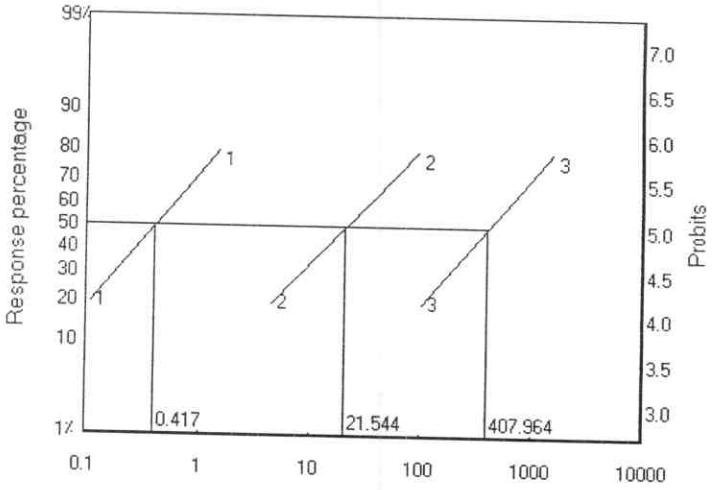
1- Brodifacoum 2- Chlorophacinone 3- Warfarin

Fig.(6): Log doses probit lines showing response of female of albino house mouse *Mus musculus* treated with Warfarin, Chlorophacinon and Brodifacoum fed on vegetables.



1- Brodifacoum 2- Chlorophacinone 3- Warfarin

Fig.(7): Log doses probit lines showing response of male of albino house mouse *Mus musculus* treated with Warfarin, Chlorophacinon and Brodifacoum fed on maize and wheat.



1- Brodifacoum 2- Chlorophacinone 3- Warfarin

Fig.(8): Log doses probit lines showing response of female of albino house mouse *Mus musculus* treated with Warfarin, Chlorophacinon and Brodifacoum fed on maize and wheat.

II- Biological effect :-

II-A-Effect of three sublethal doses ($^1/_{10}$ LD_{90}, $^1/_{10}$ LD_{50} and $^1/_{10}$ LD_{30}) of certain rodenticides on the pregnant females of albino Norway rat *R. norvegicus*:-

On implantation sites and embryos resorption:

The present results showed that, all three rodenticides induced a considerable reduction in numbers of implantation sites in both left and right horn uterus and these reduction widely differed according to the rodenticides type. The effect of administration sublethal doses of the three tested rodenticides in the two groups are shown in Tables (5,6) and Fig. (9, 10). It is cleared that Brodifacoum and Chlorophacinone at $^1/_{10}$ LD_{90} in the two cases of feeding were more effective than both sublethal doses as well as the same dose from Warfarin. Also, the obtained data revealed that in untreated females all implantation sites formed fetuses without any resorbed ones. On the other hand, administration of the three rodenticides induced a noticeable reduction in formed fetuses in the two cases of feeding. These mentioned that a highly significant reduces in the mean of implantation when females were treated with Brodifacoum and Chlorophacinone at $^1/_{10}$ LD_{90} in both cases of feeding. Also, there was a significant reduce in the mean of implantation when females which feeding on maize and wheat were treated with Brodifacoum at $^1/_{10}$ LD_{50} while, there was non-significant reduce in the mean of implantation in other cases. Finally, the maximum reduction was observed in both cases with percentage of 100% when females were treated with Brodifacoum and

Chlorophacinone at $^{1}/_{10}$ LD_{90}, while minimum reduction was noticed when females which were feeding on maize and wheat were treated with Warfarin at $^{1}/_{10}$ LD_{30}, where the percentage of reduction was 12.5%. The previous results mentioned that all anticoagulants were very active and increase the percentages of the absorbed fetuses, in all the chosen sublethal doses $^{1}/_{10}$ LD_{90}, $^{1}/_{10}$ LD_{50} and $^{1}/_{10}$ LD_{30} respectively.

II-B-Effect of $^{1}/_{10}$ LD_{30} of the rodenticides on females and fetuses of albino Norway rat:-

II-B-1-On gestation period and number & weight of fetuses:

Data presented in Table (7,8) indicated that the effect of sublethal dose $^{1}/_{10}$ LD_{30} of the three rodenticides, Brodifacoum, Chlorophacinone and Warfarin on the gestation period, number and weight of fetuses in two groups, where females were feeding on maize and wheat in the first group and vegetables in the second one. The obtained results appeared that, the sublethal dose $^{1}/_{10}$ LD_{30} of all anticoagulants have non-significant effect on both gestation period and weight of fetuses in the two groups. But they have a highly significant effect on the mean number of fetuses when females which were feeding on maize and wheat treated with Brodifacoum and Chlorophacinone. Also, the same results were obtained when females fed on vegetable treated with Brodifacoum, while, the other treatments gave a significant effect on the number of fetuses in two groups of feeding.

II-B-2-On time weaning and opening eyes:

The presented data mentioned that, the effect of sublethal dose $^{1}/_{10}$ LD_{30} of the three rodenticides, Brodifacoum, Chlorophacinone and Warfarin on the mean of time weaning per days and mean of opening eyes per days in the two groups of feeding type. The obtained results showed that, the sublethal dose $^{1}/_{10}$ LD_{30} from Brodifacoum in the two cases of feeding have a significantly increase on the mean time of weaning per days. While, there were non-significant increase on the mean time of weaning per days with other treatments in two cases of feeding. Also, there was non-significant increase on the mean of opening eyes in all treatments with the three rodenticides in two groups of feeding. As concerns embryotoxicity activity in pregnant females rats during the gestation period, all the three rodenticides were very active and increased the percentages of the absorbed fetuses in all the three chosen sublethal doses, i.e. $^{1}/_{10}$ LD_{90}, $^{1}/_{10}$ LD_{50} and $^{1}/_{10}$ LD_{30}. These results are agreed with the results reported by several authors, **Sherif *et al.*, (1989),** who concluded that, the treatment with Warfarin increased markely the percentages of resorbed fetuses and decreased the foetal weight and length. The same results were found by **Sherif (1991),** who reported that, Tamaron treatment increased the percentage of resorbed fetuses, while, the foetal weight and length were decreased. Also, the same trend was reported by **El-Ashmaoui and Salah, (1994) and Kim *et al.*, (2000).**

Youssef (1994), showed that the results obtained indicated that the sublethal doses of the tested rodenticides caused abortion and resorption fetuses to the treated pregnant

females during the different weeks. Also, **Ibrahim (2001),** staled the effect of ¼ LD_{50} of same plant extracts on pregnancy of albino rat. The author was remarkable the drastic potential harmful effects on the fetuses when females treated with plant extracts at the progressed pregnancy stages. Also, He was observed the resorption effect as internal hamorrhage inside the uterus of the pregnant females when compared with those of the untreated pregnant females. Finally, **El-Essely, (2002),** proved that the pregnant female rats treated with the sublethal doses of Chlorophacinone and Warfarin at the 3^{rd} day of pregnancy the percentage of the resorbed fetuses increased in all the doses depending on the dose level. The author, also, showed that tested anticoagulants have an embeyotoxicity effect on the pregnant female rats during the first week of gestation period. Also, He was found non-significant effect for the two tested anticoagulant neither on the gestation period of the treated pregnant females, nor on the weight of the results fetuses from treated mothers.

Table (5): Biological effect of the anticoagulants on numbers of implantation and resorption of embryoes of albino Norway rat *R. norvegicus* fed on maize and wheat.

Dose mg/kg	Uterus	Anticoagulant														
		Brodifacoum					Chlorophacinone					Warfarin				
		Mean ± S.E. implantation	Mean ± S.E. resorption	% resorption	% reduction	Computed T implantation	Mean ± S.E. implantation	Mean ± S.E. resorption	% resorption	% reduction	Computed T implantation	Mean ± S.E. implantation	Mean ± S.E. resorption	% resorption	% reduction	Computed T implantation
$^1/_{10}$ LD_{90}	Left	0	0	0	0		0	0	0	0		3 ± 0.35	3 ± 0.35	100%		
	Right	0	0	0	0		0	0	0	0		3 ± 0.5	3 ± 0.5	100%		
	Total	0	0	0	100%	10.1**	0	0	0	100%	10.1**	6 ± 0.35	6 ± 0.35	100 %	25 %	2.31
$^1/_{10}$ LD_{50}	Left	3 ± 0.35	0	0 %			3 ± 0.35	1 ± 0.35	33.3%			3 ± 0.35	0	0 %		
	Right	2 ± 0.5	2 ± 0.5	100%			3 ± 0	3 ± 0	100%			4 ± 0.35	4 ± 0.35	100%		
	Total	5 ± 0.79	2 ± 0.5	40%	44.4%	2.68*	6 ± 0.35	4 ± 0.35	66.6%	33.3%	2.31	7 ± 0.7	4 ± 0.35	57.1%	12.5%	0.94
$^1/_{10}$ LD_{30}	Left	3 ± 0.5	0	0 %			3 ± 0	0	0 %			4 + 0.61	0	0 %		
	Right	3 ± 0.0	0	0 %			4 ± 0.35	0	0 %			3 ± 0.61	0	0 %		
	Total	6 ± 0.5	0	0 %	33.3%	2.14	7 ± 0.35	0	0 %	77.7%	1.16	7 ± 0.0	0	0 %	12.5%	1.26
Control	Left	4 + 0.61	0	0 %												
	Right	4 ± 0.35	0	0 %												
	Total	8 ± 0.79	0	0 %												

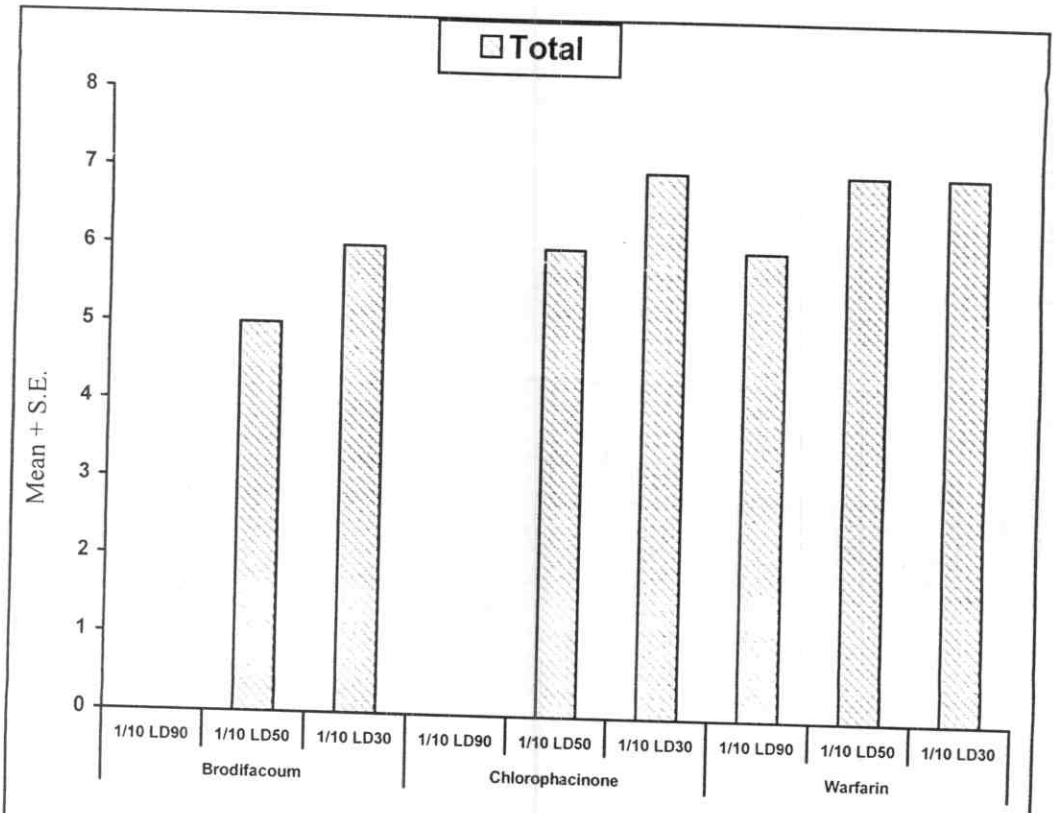


Fig (9): Biological effect of the anticagulants on numbers of implantation and resporption of embryoes of albino Norway rat *R. norvegicus* fed om maize and wheat.

Table (6): Biological effect of the anticoagulants on numbers of implantation and resorption of embryoes of albino Norway rat *R. norvegicus* fed on vegetables.

Dose mg/kg	Uterus	Anticoagulant														
		Brodifacoum					Chlorophacinone					Warfarin				
		Mean ± S.E. implantation	Mean ± S.E. resorption	% resorption	% reduction	Computed T implantation	Mean ± S.E. implantation	Mean ± S.E. resorption	% resorption	% reduction	Computed T implantation	Mean ± S.E. implantation	Mean ± S.E. resorption	% resorption	% reduction	Computed T implantation
$^{1}/_{10}$ LD_{90}	Left	0	0	0	0		0	0	0	0		2 ± 0.35	1 ± 0.35	50%		
	Right	0	0	0	0		0	0	0	0		3 ± 0	3 ± 0	100%		
	Total	0	0	0	100%	7.5**	0	0	0	100%	7.5**	5 ± 0.35	4 ± 0.35	80 %	42.9 %	2.01
$^{1}/_{10}$ LD_{50}	Left	3 ± 0.61	2 ± 0.35	66.6%			3 ± 0.35	1 ± 0.35	33.3%			3 ± 0.5	1 + 0.5	33.3 %		
	Right	2 ± 0.61	1 ± 0	50%			3 ± 0.5	3 ± 0.5	100%			3 ± 0.0	2 ± 0	66.6%		
	Total	5 ± 1.1	3 ± 0.35	60%	28.6%	1.39	6 ± 0.61	4 ± 0.61	66.6%	14.3%	0.9	6 ± 0.5	4 ± 0.5	50%	14.3%	0.95
$^{1}/_{10}$ LD_{30}	Left	3 ± 0	2 ± 0.35	66.6%			3 ± 0.61	0	0 %			3 + 0.5	0	0 %		
	Right	3 ± 0.35	0	0 %			4 ± 0.61	0	0 %			4 ± 0.79	1 + 0.79	25 %		
	Total	6 ± 0.35	2 ± 0.35	33.6 %	14.3%	1.01	7 ± 0.0	0	0 %	0%	0	7 ± 0.5	1 + 0.5	14.3 %	0%	0
Control	Left	4 + 0.93	0	0 %												
	Right	3 ± 0.5	0	0 %												
	Total	7 ± 0.93	0	0 %												

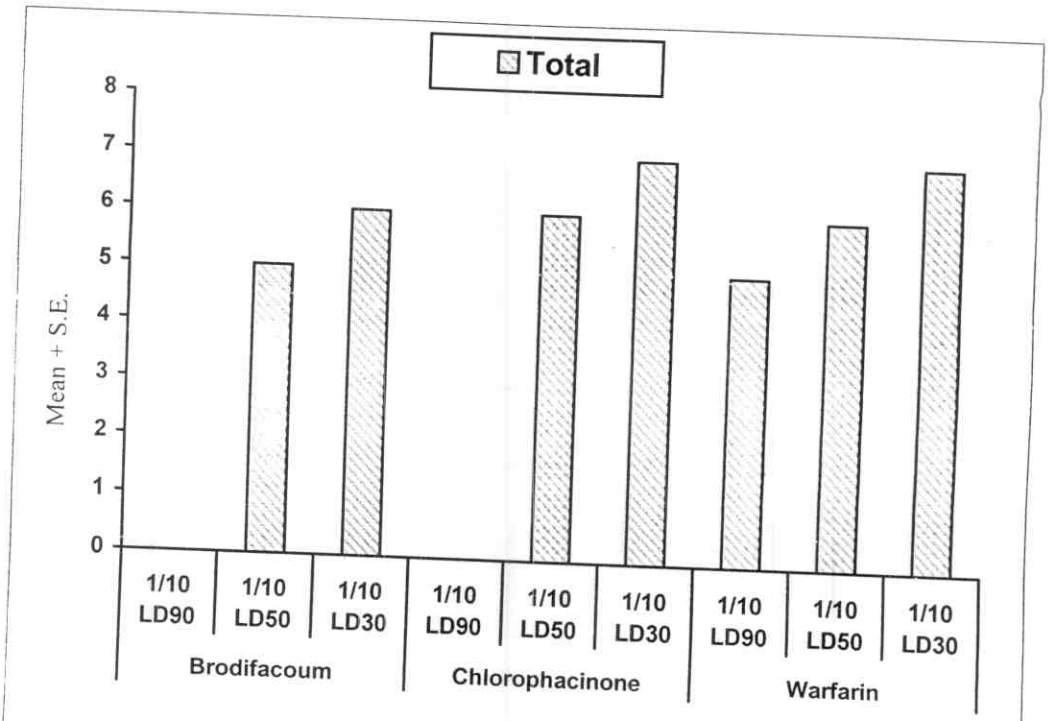


Fig (10): Biological effect of the anticoagulants on numbers of implantation and resporption of embryos of albino Norway rat *R. norvegicus* fed on vegetables.

Table (7): Biological effect of 1/10 LD_{30} of the rodenticides on female and fetuses of albino Norway rat *R. norvegicus* fed on maize and wheat.

Treatments	Mean of gestation period / day	Computed T	Mean + S.E. No. of fetuses			Computed T Alive	Mean weight of fetuses (gm)	Computed T	Mean of time weaning (days)	Computed T	Mean of opening eyes (days)	Computed T
			Alive	Mortality	% Mortality							
Brodifacoum	21.5 ± 0.29	0.52	1 ± 0.35	3 ± 0.4	75	6.84**	4.2 ± 0.45	2.37	27 ± 0.79	3.5*	12 ± 0.61	2.39
Chlorophacinone	21.5 ± 0.35	0.51	3 ± 0.45	2 ± 0.82	40	4.71**	4.3 ± 0.61	1.97	25 ± 0.41	2.18	11 ± 0.41	1.92
Warfarin	22 ± 0.41	1	4 ± 0.61	1 ± 0.4	20	3.51*	4.7 ± 0.56	1.57	25 ± 0.61	1.96	11 ± 0.81	1.59
Control	21 ± 0.91		8 ± 0.96	1 ± 0.61	11.11		6.0 ± 0.61		23 ± 0.82		9 ± 0.96	

Table (8): Biological effect of 1/10 LD_{30} of the rodenticides on female and fetuses of albino Norway rat *R. norvegicus* fed on vegetable.

Treatments	Mean of gestation period / day	Computed T	Mean + S.E. No. of fetuses			Computed T Alive	Mean weight of fetuses (gm)	Computed T	Mean of time weaning (days)	Computed T	Mean of opening eyes (days)	Computed T
			Alive	Mortality	% Mortality							
Brodifacoum	24 ± 0.79	2.68*	1 ± 0.61	2 ± 0.61	66.7	4.56**	4.3 ± 0.35	1.71	28 ± 0.92	3.25*	12 ± 0.82	2.38
Chlorophacinone	23 ± 0.56	2.0	2 ± 0.82	3 ± 0.4	60	3.27*	4.5 ± 0.4	1.37	26 ± 0.56	2.01	10 ± 0.41	0.96
Warfarin	22.5 ± 0.35	1.64	3 ± 0.56	2 ± 0.35	40	2.8*	4.8 ± 0.56	0.85	26 ± 0.61	1.95	10 ± 0.82	0.79
Control	21.5 ± 0.5		6 ± 0.91	1 ± 0.4	14.3		5.5 ± 0.61		24 ± 0.82		9 ± 0.96	

III-Biochemical response:-

III-A- ALT and AST enzymes :

Aminotransferase represent a group of enzymes present in the cytoplasm of living cells in all tissues, they are complex, naturally occurring compounds that catalyze the biochemical reactions of the body, i.e. they speed up reactions the might other wise proceed very slowly. Each tissue has its own specific enzyme, one enzyme can be common to more that one type of tissue. For example, Alanine Aminotransferase ALT (GPT) is found mainly with the highest concentration in the liver and to lesser extent in tissues such as brain muscle and kidneys (**Kachman and Moss 1976**).

Aspartate Aminotransferase AST (GOT) is found mainly not only in heart and skeletal muscle but also in the liver, kidneys and blood cells (**Wilson 1986**). Transaminases are important and critical enzymes in the biological processes, they play a role in amino acid catabolism and biosynthesis, consequently, they are considered as specific indicators of liver damage. Normally, plasma ALT and AST are low but after extensive tissue damage these enzymes are liberated into the blood (**Kachmor, 1970**).

III-A-1-Effect of Brodifacoum, Chlorophacinone and Warfarin on Alanine Aminotransferase (ALT):

Alanine Aminotransferase (ALT) is found mainly in liver cell, thus an elevated serum level (s GPT) is a definite sign of

acute hepato cellular injury. The normal s GPT value rules hepatic origin of the enzyme.

This part of the present study is an attempt to measure the effect of sublethal doses ($^1/_{10}$ LD_{90}, $^1/_{10}$ LD_{50} and $^1/_{10}$ LD_{30}) of the three rodenticides on Alanine Aminotransferase (ALT) activity in plasma in both sexes of albino Norway *R. norvegicus* rats, which were fed on maize and wheat in the first experiment and vegetable in the second one.

Obtained results in Table (9) Fig. (11 & 12) showed that, the amount of ALT enzyme recorded in check control was less than the amount in all treatments, while the amount of ALT enzyme in plasma of the albino Norway *R. norvegicus* rats increased after rodenticides treatments. Whereas a significant increase in the level of enzyme was found when females were treated with the three rodenticides at the sublethal dose $^1/_{10}$ LD_{90}. The same trend was observed when females were treated at $^1/_{10}$ LD_{50}, while no significant increase was observed, when females were treated with Warfarin at this dose. Also, when females were treated with the three rodenticides at $^1/_{10}$ LD_{30}, no significant increase in the level of enzyme was obtained. These results were recorded when albino Norway *R. norvegicus* rats were fed on vegetables. The same results were observed when females were fed on maize and wheat. The maximum increase was observed when females were fed on maize and wheat with difference of 46.2% then 45.0% when fed on vegetables at $^1/_{10}$ LD_{90}, while the minimum increase was noticed at $^1/_{10}$ LD_{30} when females were

fed on maize and wheat with different of 5.8% then 6% when females were fed on vegetables.

However, when males were fed on maize and wheat or fed on vegetables, the level of ALT enzyme in the plasma showed highly significant increase from 7.5 µ/L prc. treatment to 13.5 µ/L post-treatment with difference of 80% when males treated at $^{1}/_{10}$ LD_{90} with Brodifacoum when fed on maize and wheat, the same result was recorded for males fed on vegetables, whereas a highly significant increase was noticed. Values increased from 7.0 µ/L before treatment to 11.4 µ/L after the treatment with a difference of 62.8%. Similar results was obtained when the males were treated with Chlorophacinone at the $^{1}/_{10}$ LD_{50} , where by the difference amounted 52.0% when males were fed on maize and wheat. On the other hand only 40.0% increase was recorded using other food.

Results showed also a significant increase for the males fed on vegetables while highly significant increase was found when males were fed on maize and wheat at the $^{1}/_{10}$ LD_{90} of Chlorophacinone. Also, when albino Norway *R. norvegicus* rats were treated with Warfarin at the $^{1}/_{10}$ LD_{90} there was a significant increase in ALT enzyme during the two experiments. On the same time there was no significant increase in the level of enzyme at $^{1}/_{10}$ LD_{30} when albino Norway *R. norvegicus* rats were treated with the three rodenticides in the two experiments, where the minimum increase was noticed with difference of 14.3% when the males were fed on vegetables but only 21.3% increase in the control of the enzyme was observed for other food.

The present results were in agree with those of **El-Garawany *et al.*, (1990),** they reported that, plasma GPT showed an increase with the three Chemicals, used at $^{1}/_{20}$ LD_{50} of thallium sulfate as a rodenticide, permethrin as an insecticide and Floumethuron as a herbicide against three groups of adult male rats. Similar result was obtained by **Youssef 1996**, also, who stated that a significant increase of the level enzyme GPT in plasma of the two rodent species after Brodifacoum treatment at ¼ LD_{50}.

Ahmady *et al.*, (1997), reported that s highly significant increase was also found in the level enzyme ALT in plasma of male albino Norway *R. norvegicus* rats, when the effect of calciferol at two doses ¼ LD_{50} and $^{1}/_{16}$ LD_{50} were studied. A similar effect was recorded by **El-Essely (2002),** after using Chlorophacinone and Warfarin rodenticides at $^{1}/_{10}$ and ¼ LD_{50}, which induced a general increase in ALT enzyme activity in plasma for two rodenticides with difference percentage, 14.26, 46.52, 46.52 and 35.8, respectively. On the other hand, **Shooba, (2003)** studied the effect of Chlorophacinone at ¼ LD_{50} on serum Alanine Aminotransferase (ALT). The author found drastically increase with the prolongation of post-treatment and highly significant increase with difference of 238.8%.

III-A-2- Effect of Brodifacoum, Chlorophacinone and Warfarin on Aspartate Aminotransferase (AST):-

The transaminase enzyme catalyse the conversion one amino acid to the corresponding keto acid, with simultaneous conversion of another keto acid to an amino acid, transamination

reaction in many tissues. Norway, almost all of this enzyme is intracellular. Following the injury or death of physiologically active cells, the (GOTs) enzyme is released into serum. The amount of GOT is directly proportional to the number of cells damaged and the interval of time between tissue injury and GOTs determination **(Tilkian et al, 1983)**.

Obtained results in Table (10) Fig (13 & 14) showed that the influence of the sublethal doses ($^1/_{10}$ LD_{90}, $^1/_{10}$ LD_{50} and $^1/_{10}$ LD_{30}) of the three rodenticides on Aspartate Aminotransferase AST activity in plasma in both sexes of albino Norway *R. norvegicus* rats, which were fed on maize and wheat in the first experiment and vegetables in the second one. The effect of the three rodenticides on serum AST was in harmony pattern with the effect of these rodenticides on serum ALT, where the recorded amount of AST enzyme in check control was lower than the amount in all treatments. The amount of AST enzyme in plasma of the albino Norway *R. norvegicus* rats was increased after rodenticides treatments, but their effect on plasma AST was more severe than their effects on plasma ALT. Also, data mentioned that, were a highly significant increase in the level of AST enzyme when both sexes were treated with Brodifacoum and Chlorophacinone at the sublethal dose ($^1/_{10}$ LD_{90}) in the two experiments. Regarding the effect of Brodifacoum at $^1/_{10}$ LD_{50}, the tabulated data pointed out that plasma AST recorded a significant increase in case of females fed on vegetables and the results were highly significant when the males were fed on vegetables, maize and wheat. On the same time, the effect of Chlorophacinone at $^1/_{10}$ LD_{50} was equal to the effect of Warfarin

at $^{1}/_{10}$ LD_{90} , where, there was a significant increase in the level of enzyme in case of females and was highly significant with males in the two experiments. On the other hand, there was no significant increase in the level of AST enzyme at $^{1}/_{10}$ LD_{30} when albino Norway rats *R. norvegicus* were treated with the three rodenticides in the two experiments. Also, the same results were obtained at $^{1}/_{10}$ LD_{50} after Warfarin treatment. Also, results showed that, the maximum increase values were observed when males and females were fed on vegetables, maize and wheat at $^{1}/_{10}$ LD_{90}. From previously mentioned results, it can be proposed that the increase in plasma enzyme level may be attributed to increase of all membrane permeability .

In this respect **Abdel-Raheem *et al.*, (1986)**, stated an increase in serum AST enzyme in orally administrated LD_{50} of anticoagulant rodenticides (Warfarin and racoumin), but an treatment with sublethal dose of Warfarin drastic increase in AST level at 15 days after administration was noticed. **Youssef, (1994)** reported also, that when anticoagulant rodenticides i.e. bromadiolone, coumachlor and coumatetralyl were tested at higher doses (1.5 and 2.0 mg/ kg b.w) of female albino mice (*M. musculus*) they caused highly elevated activity of serum AST. **Youssef (1996)** studied also, the effect of Brodifacoum at ¼ LD_{50} the auther found a significant increase of the level enzyme GOT in plasma of both rodent species. An the same trend, **Ahmady *et al.*, (1997)** were found a highly significant increase of the level enzyme AST in plasma of male albino rats during post-treatment, when they investigated the effect of calciferol rodenticide at two doses ¼ LD_{50} and $^{1}/_{16}$ LD_{50}. the

present results were in agree with these of **Shooba, (2003)**. who mentioned that, Chlorophacinone administration increased highly significant AST level in serum, when the effect of Chlorophacinone at ¼ LD_{50} was studied. Finally, **Gabr, *et al.*, (2004),** showed also a markedly increase in AST (aspartate aminotransferase), ALT (alanine aminotransferase) enzymes level in plasma after 24 and 72h post-treatment, when the effect of ¼ LD_{50} of Oshar extract was studied against albino Norway rats *R. norvegicus*.

Table (9): Effect of certain rodenticides on Alanine Aminotrnsferase (ALT) in both sexes of the albino Norway rat, *R. norvegicus* .

Rodenticides	Dose	Type of food before treatment											
		Vegetables						Maize and wheat					
		Female			Male			Female			Male		
		Mean ± SE	% of different	Computed T	Mean ± SE	% of different	Computed T	Mean ± SE	% of different	Computed T	Mean ± SE	% of different	Computed T
Brodifacoum	Control	10 ± 0.96	-	-	7 ± 0.75	-	-	10.4 ± 0.1	-	-	7.5 ± 0.8	-	-
	1/10 LD90	14.5 ± 1.1	45.0	3.08*	11.4 ± 0.8	62.8	4.01**	5.2 ± 0.96	46.2	3.45*	13.5 ± 1.2	80	4.2**
	1/10 LD50	13.8 ± 0.96	38.0	2.84*	10.3 ± 0.8	47.1	3.01*	14.3 ± 0.84	37.5	2.98*	12.3 ± 0.96	64	3.81**
	1/10 LD30	11 ± 0.44	10.0	0.94	9 ± 0.9	28.6	1.7	11.3 ± 0.92	8.7	0.66	10. ±	33.3	2.21
Chlorophacinone	Control	10 ± 0.96	-	-	7. ± 0.75	-	-	10.4 ± 1	-	-	7.5 ± 0.8	-	-
	1/10 LD90	13.4 ± 0.6	34.0	3.00*	11.2 ± 0.96	60	3.44*	14.4 ± 0.84	38.5	3.05*	12.1 ± 0.9	61.3	3.83**
	1/10 LD50	12.5 ± 0.7	25.0	2.46*	9.8 ± 0.6	40	2.92*	13.4 ± 0.64	28.2	2.52*	11.4 ± 0.96	52	3.12*
	1/10 LD30	11 ± 0.92	10.0	0.75	8.2 ± 0.6	17.1	1.25	11.6 ± 0.6	11.5	1.03	9.8 ± 0.9	30.7	1.92
Warfarin	Control	10 ± 0.96	-	-	7 ± 0.75	-	-	10.4 ± 1	-	-	7.5 ± 0.8	-	-
	1/10 LD90	12.7 ± 0.4	27.0	2.5*	10.8 ± 1.2	54.3	2.67*	13.6 ± 0.8	30.8	2.5*	11.8 ± 1.1	57.3	3.16*
	1/10 LD50	11.4 ± 0.6	14.0	1.23	9.2 ± 0.8	31.4	2.01	11.9 ± 0.92	14.4	1.11	10.1 ± 0.9	34.7	2.17
	1/10 LD30	10.6 ± 0.5	6.0	0.51	8. ± 0.9	14.3	0.85	11.0 ± 0.24	5.8	0.58	9.1 ±	21.3	1.27

* Tabulated T at 5 % = 2.45
** Tabulated T at 1 % = 3.71
d. f. = 6

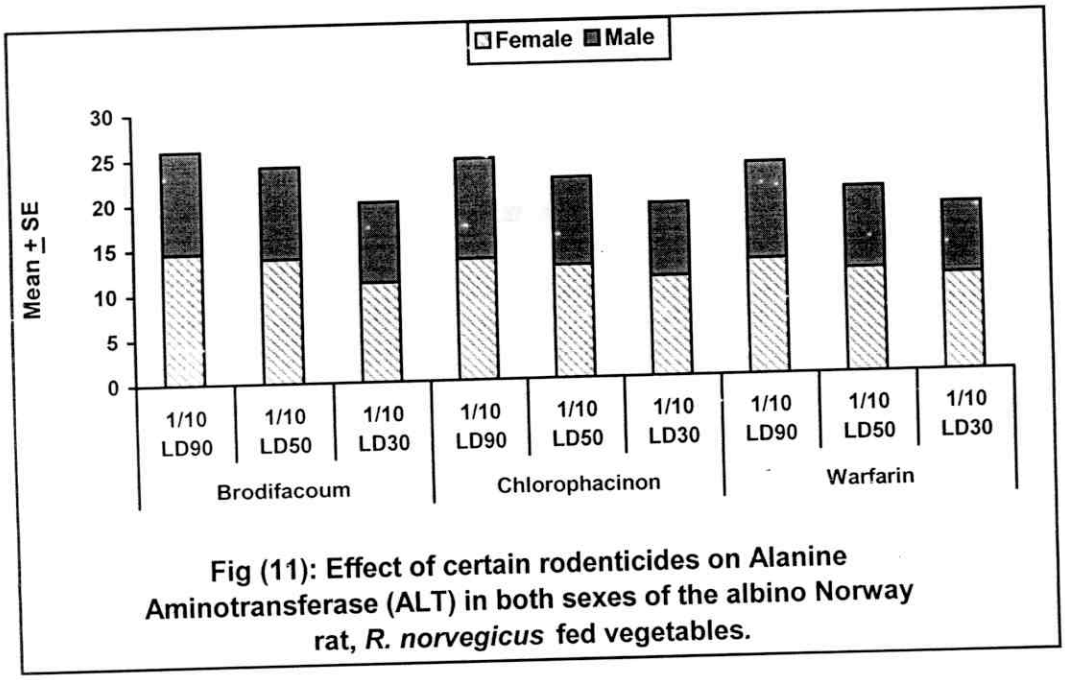


Fig (11): Effect of certain rodenticides on Alanine Aminotransferase (ALT) in both sexes of the albino Norway rat, *R. norvegicus* fed vegetables.

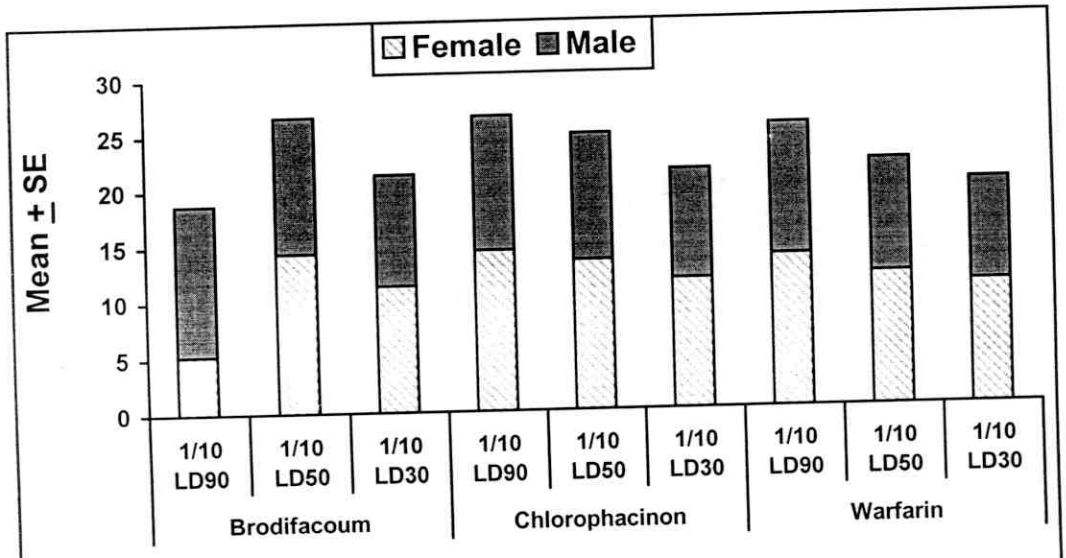


Fig (12): Effect of certain rodenticides on Alanine Aminotransferase (ALT) in both sexes of the albino Nerway rat, *R. norvegicus* fed maize and wheat.

Table (10): Effect of certain rodenticides on Aspartate Aminotransferase (AST) in both sexes of the albino Norway rat, *R. norvegicus* .

Rodenticides	Dose	Type of food before treatment											
		Vegetables						Maize and wheat					
		Female			Male			Female			Male		
		Mean ± SE	% of different	Computed T	Mean ± SE	% of different	Computed T	Mean ± SE	% of different	Computed T	Mean ± SE	% of different	Computed T
Brodifacoum	Control	7.75 ± 0.75	-	-	5.2 ± 1	-	-	8.4 ± 0.84	-	-	5.6 ± 0.96	-	-
	1/10 LD90	17 ± 2.12	119.4	4.11**	1.5 ± 1.22	198	6.52**	20.3 ± 2.2	141.7	5.04**	16.8 ± 1.44	200	6.47**
	1/10 LD50	13.75 ± 1.44	77.42	3.7*	13. ± 1.22	150	4.94**	16.6 ± 1.9	97.6	3.94**	14.2 ± 1.4	153.6	5.1**
	1/10 LD30	10.75 ± 1.44	38.7	1.85	8.5 ± 1.44	63.5	1.88	12.8 ± 2.2	52.4	1.86	9.4 ± 2.2	67.8	1.58
Chlorophacinone	Control	7.75 ± 0.75	-	-	5.2 ± 1	-	-	8.4 ± 0.84	-	-	5.6 ± 0.96	-	-
	1/10 LD90	14.5 ± 1.6	87.1	3.81**	15.2 ± 1.44	192.3	5.7**	18.8 ± 2.5	123.8	3.93**	14 ± 1.2	150	5.45**
	1/10 LD50	10.75 ± 0.75	38.7	2.83*	11.5 ± 1.2	121.2	4.03**	15.5 ± 1.9	84.5	3.38*	11.8 ± 0.96	110.7	4.56**
	1/10 LD30	9.25 ± 0.87	19.35	1.3	8.5 ± 1.44	63.5	1.88	10.8 ± 0.8	28.6	2.06	9.2 ± 1.6	64.3	1.92
Warfarin	Control	7.75 ± 0.75	-	-	5.2 ± 1	-	-	8.4 ± 0.84	-	-	5.6 ± 0.96	-	-
	1/10 LD90	11.75 ± 0.96	51.6	3.28*	15.3 ± 2.12	194.2	4.32**	16.8 ± 2.2	100	3.56*	13.8 ± 1.44	146	4.74**
	1/10 LD50	10.75 ± 1.44	38.7	1.85	11.2 ± 2.25	115.3	2.43	11.6 ± 1.2	38.1	2.18	11.4 ± 2.2	103.6	2.41
	1/10 LD30	8.5 ± 0.75	19.68	0.71	8.3 ± 1.2	59.6	1.98	10.2 ± 1.44	21.4	1.1	8.4 ± 1.6	50	1.49

* Tabulated T at 5 % = 2.45
** Tabulated T at 1 % = 3.71
d. f. = 6

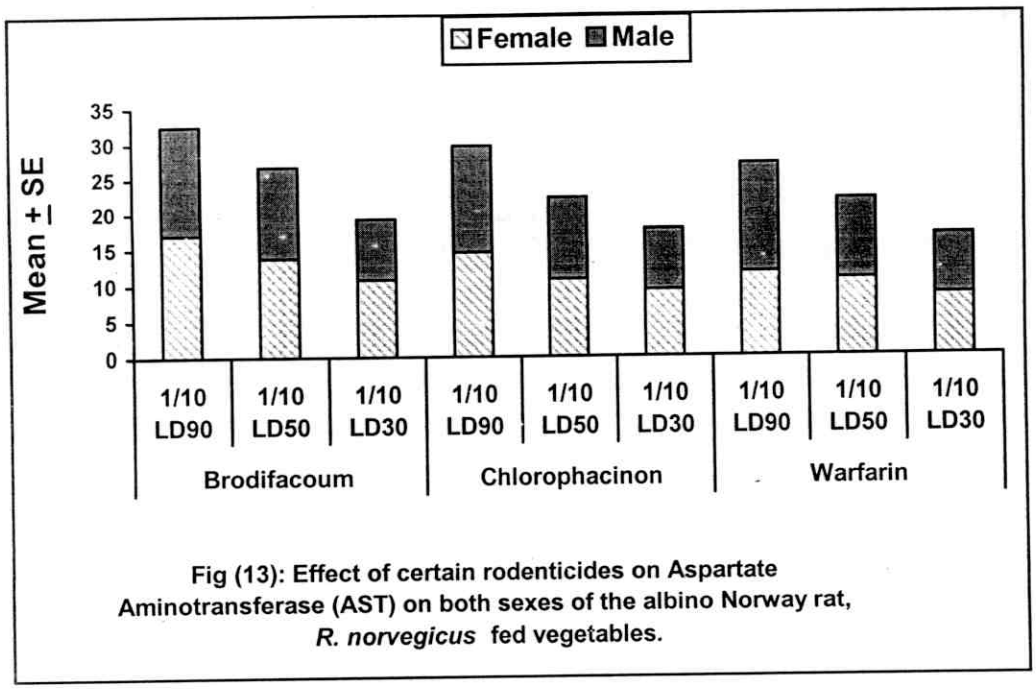


Fig (13): Effect of certain rodenticides on Aspartate Aminotransferase (AST) on both sexes of the albino Norway rat, *R. norvegicus* fed vegetables.

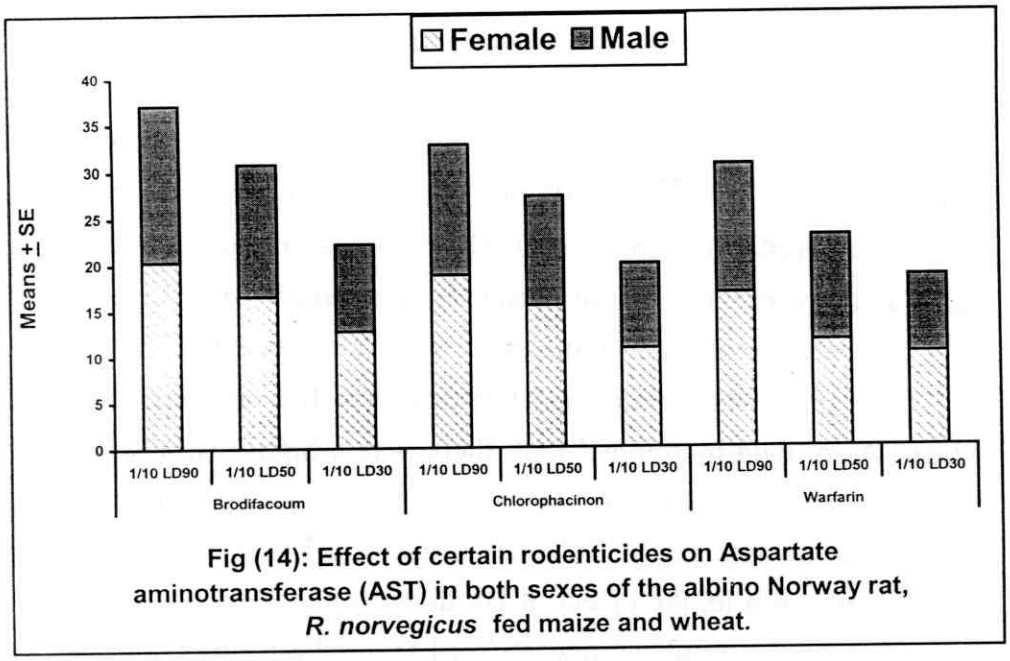


Fig (14): Effect of certain rodenticides on Aspartate aminotransferase (AST) in both sexes of the albino Norway rat, *R. norvegicus* fed maize and wheat.

III-B- Total protein:

Plasma protein serves as a source for rapid replacement of tissue proteins during tissue depletions, as buffers in acid base balance, and as transporters for the constituents of the blood, such as lipids, vitamins, iron, copper and certain enzyme.

A number of the plasma proteins participate in blood coagulation. The total protein, ranges between 52% and 68% as albumin. This fraction id responsible for about 80% of the colloid oncotis pressure in the serum. The capillary walls are impermeable to proteins in plasma, the protein; therefore, except an osmotic force across the capillary wall (oncotic pressure) that tends to attract water into the blood.

The effect of Brodifacoum Chlorophacinone and Warfarin on total protein in plasma of albino Norway *R. norvegicus* rats shown in Table (11) Figs (15, 16). The obtained results revealed that the three rodenticides induced an increase in total protein level in plasma of treated albino Norway *R. norvegicus* rats when measured after treatments, then compared with control value as the averages of total protein in the control were 12 μ/L, 12.4 μ /L when males and females were fed on vegetable, 15.5 μ /L, 16.6 μ /L when males and females were fed on maize and wheat. Also, data mentioned that, there was a highly significant increase in the level of protein when both sexes were treated with Brodifacoum at the sublethal dose $^{1}/_{10}$ LD_{90} in the two experiments. While, the effect of Brodifacoum at $^{1}/_{10}$ LD_{50} equal the effect of Chlorophacinone at $^{1}/_{10}$ LD_{90}, where there were a highly significant increase in the level of total protein in case of

males and females which were feeding on vegetable and males feeding on maize and wheat, but there was a significant increase in case of females which feeding on maize and wheat. Another trend was observed, where a significant increase in the level of protein when both sexes were treated with Chlorophacinone at $^{1}/_{10}$ LD_{50} in the two experiments, while the tabulated data protein out that plasma total protein recorded a significant increase in case of females and highly significant increase in case of males in the two experiments, when albino rats were treated with Warfarin at $^{1}/_{10}$ LD_{90}. On the same time, there was no significant increase in the level of total protein at $^{1}/_{10}$ LD_{30} when albino Norway *R. norvegicus* rats were treated with the three rodenticides in the two experiments, also the same results were obtained at $^{1}/_{10}$ LD_{50} when albino Norway *R. norvegicus* rats were treated with Warfarin in the two experiments. The maximum increase was noticed with difference of 105.2% when males were feeding on maize and wheat at $^{1}/_{10}$ LD_{90}, when albino Norway *R. norvegicus* rats were treated with Brodifacoum on the ether hand, the minimum increase was observed at $^{1}/_{10}$ LD_{30}, when females were feeding on maize and wheat with difference of 3%. These results agree with those of **Warnick and carter (1972)**, who they reported that, serum total protein showed significant increase in pesticide formulators and aircraft pilots than in the control subjects.

The same results were obtained, when **Zedan (1991)** tested same insecticides, sumicidin, suithian, sumialpha and cyenox on albino mice. They found that the total protein increase by the tested insecticides depending up on the dose used and

time after treatment according to the type insecticides. Also, **Youssef (1996)** reported that Brodifacoum at ¼ LD_{50} gave a significant increase in the level of total protein in plasma of *R. rattus* and *R. norvegicus* when these rats were treated orally.

Also, El-Essely (2002), studied the effect of ($^1/_{10}$, $^1/_{14}$ LD_{50}) Chlorophacinone and Warfarin on total protein in plasma. He found an increase in plasma total protein in albino Norway *R. norvegicus* rats after treated by the two rodenticides. Also, **Gabr et al., (2004)** was found the same results when they studied the effect of sublethal dose ($^1/_4$ LD_{50}) of Oshar crude plant extracted by ethanol on total protein in blood plasma. They showed that Oshar extract caused increase total protein in plasma with highly significant ant its values were 8.3 and 11.6 mg at 24 and 72h post-treatment, consecutively comparing with 6.7 mg in control with 23.9 and 73.1% differences, respectively.

Table (11): Effect of certain rodenticides on Total protein in both sexes of the albino Norway rat, *R. norvegicus* .

Rodenticides	Dose	Type of food before treatment											
		Vegetables						Maize and wheat					
		Female			Male			Female			Male		
		Mean ± SE	% of different	Computed T	Mean ± SE	% of different	Computed T	Mean ± SE	% of different	Computed T	Mean ± SE	% of different	Computed T
Brodifacoum	Control	12.4 ± 0.94	-	-	12 ± 0.9	-	-	16.6 ± 2.5	-	-	15.5 ± 2.4	-	-
	1/10 LD90	19. ± 0.48	53.2	6.23**	18.8 ± 0.49	56.6	6.67**	29.75 ± 1.37	79.2	4.6**	31.8 ± 1.38	105.2	5.88**
	1/10 LD50	16.4 ± 0.2	32.2	4.17**	17.13 ± 0.2	42.8	5.58**	25.5 ± 0.65	53.6	3.45**	30.3 ± 2.1	95.5	4.64**
	1/10 LD30	13.9 ± 0.25	12.1	1.6	15.8 ± 1.38	31.7	2.24	20.3 ± 0.2	22.3	1.33	26.3 ± 3.9	69.7	2.36
Chlorophacinone	Control	12.4 ± 0.94	-	-	12 ± 0.9	-	-	16.6 ± 2.5	-	-	15.5 ± 2.4	-	-
	1/10 LD90	17.6 ± 0.56	42	4.78**	18.4 ± 0.6	53.3	5.93**	28.4 ± 4	71.1	2.95*	29.75 ± 1.59	91.9	4.95**
	1/10 LD50	15.6 ± 0.53	25.8	2.96*	16.4 ± 1.22	36.75	2.90*	23.9 ± 1.4	43.9	2.55*	25.3 ± 2	63.2	3.14*
	1/10 LD30	13.8 ± 0.69	11.3	1.19	14.3 ± 0.68	19.2	1.81	19.7 ± 1.2	18.7	1.12	22.3 ± 2.1	43.8	2.13
Warfarin	Control	12.4 ± 0.94	-	-	12± 0.9	-	-	16.6 ± 2.5	-	-	15.5 ± 2.4	-	-
	1/10 LD90	15.8 ± 0.46	27.4	3.12*	18.4 ± 0.44	53.3	5.71**	26.5 ± 2.55	59.6	2.77*	27.8 ± 1.9	79.4	4.02**
	1/10 LD50	14.8 ± 0.6	19.35	2.14	15.88 ± 1.2	32.3	1.72	22.7 ± 3.2	36.7	1.5	20.8 ± 2.17	34.2	1.64
	1/10 LD30	12.97 ± 0.21	4.6	0.59	13.7 ± 0.85	14.2	1.39	17.1 ± 1.6	3	0.17	16. ± 1.22	3.2	0.17

* Tabulated T at 5 % = 2.45
** Tabulated T at 1 % = 3.71
d. f. = 6

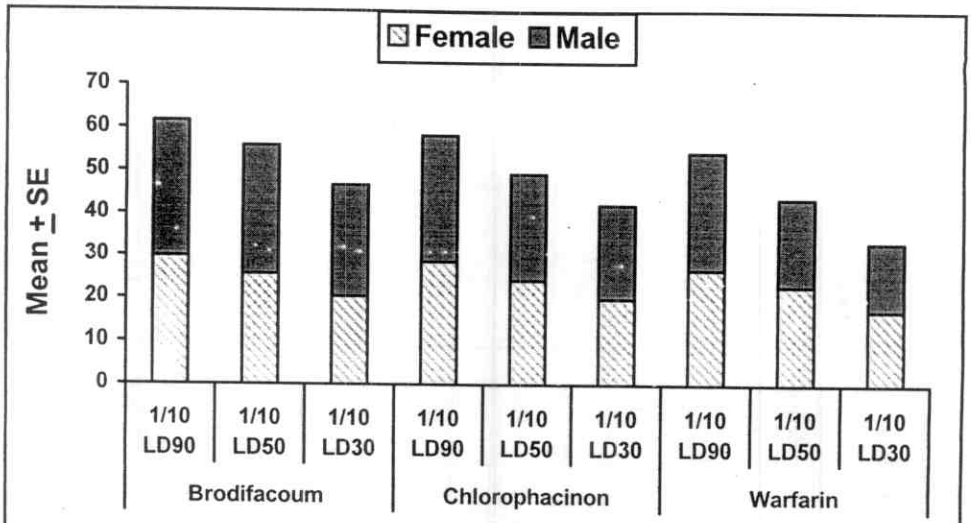


Fig (15): Effect of certain rodenticides on Total protein of both sexes of the albino Norway rat, *R. norvegicus* fed maize and wheat.

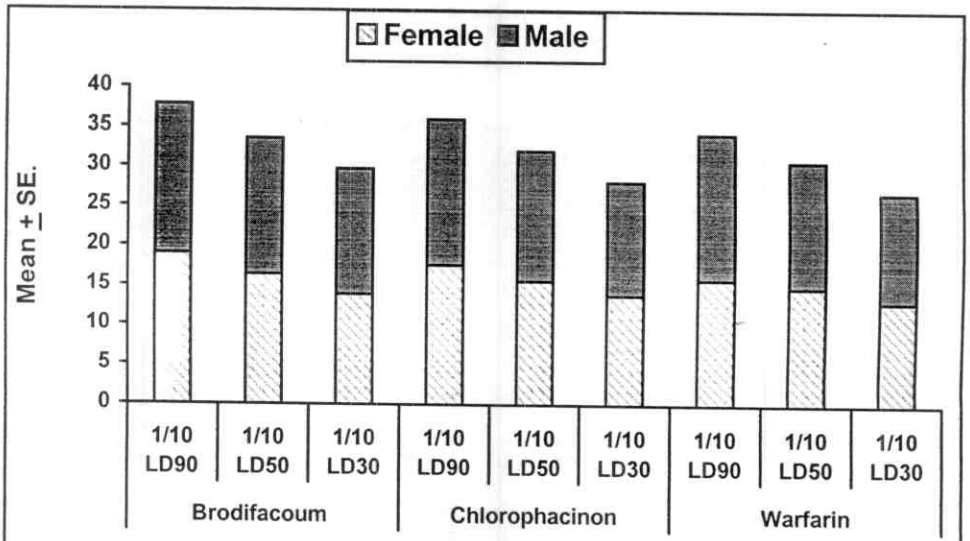


Fig (16): Effect of certain rodenticides on Total protein of both sexes of the albino Norway rat, *R. norvegicus* fed vegetables.

III-C-Cholesterol :-

Data represented at Table (12) Fig (17, 18) showed that, the effect of different doses of Brodifacoum, Chlorophacinone and Warfarin on Cholesterol level in plasma of albino Norway rat *R. norvegicus*. The obtained results revealed that the three rodenticides induced a decrease in Cholesterol level in plasma of treated albino Norway rat *R. norvegicus* when measured after treatments, then compared with control value as the averages of Cholesterol in the control were 301.28 mg/ 200dl, 325.6 mg/200dl when males and females were fed on vegetables, and they were 311.28 mg/ 200dl, 355.6 mg/ 200dl when males and females fed on maize and wheat. Also, data mentioned that, there was a significant decrease in the level of Cholesterol when both sexes were treated with Brodifacoum and Chlorophacinone at the sublethal dose $^{1}/_{10}$ LD_{90} when albino Norway rat *R. norvegicus*, were fed on vegetables. The same results were obtained when both sexes were treated with Chlorophacinone at the same dose $^{1}/_{10}$ LD_{90}, however, the effect of Brodifacoum at $^{1}/_{10}$ LD_{90} gave a highly significant decrease in the level of Cholesterol in case of males and females which were fed an maize and wheat. On the same time, another trend was observed, where non-significant decrease in the level of Cholesterol when both sexes were treated with Brodifacoum and Chlorophacinone at $^{1}/_{10}$ LD_{50} and $^{1}/_{10}$ LD_{30} in the two experiments. Also, the same results were obtained with Warfarin at all applied doses when albino Norway rat *R. norvegicus* were treated two experiments. The maximum decrease was observed when females and males were feeding on maize and wheat with difference of -37.9% then -26.7%,

followed by -25.7%, -23.5% when females and males fed on vegetables respectively. These results were obtained, when albino Norway rat *R. norvegicus* treated with Brodifacoum at $^{1}/_{10}$ LD_{90} in the two cases. While, the minimum decrease was noticed when males were treated with Warfarin at $^{1}/_{10}$ LD_{30} with difference of -2.46% when they fed on vegetable, then -4.2% when feeding on Maize and Wheat. These data in the present work and that of the literature can't accurately explain the causes of these reductions. Also, the reduction in Cholesterol content recorded in the present work may be supported by the finding of **Patyza *et al.*, (1965)**, who reported that, four injections of 100 mg coumarin/ kg to rabbits induced a decrease in the blood Cholesterol level. The same trend was found by **Mikhail (1995)**, when studied the effect of sublethal doses ($LD_{25:5}$) of Warfarin and Flocoumafen on root and Norway rats, where a significant decrease in serum Cholesterol were observed. The same anther mentioned also, that Flocoumafen proved more effectiveness on serum Cholesterol than Warfarin.

These results were in concordance with those **Hoult, *et al.*, (1996)** studied some pharmacological and biological actions of simple coumarins and its related compounds include Dicoumarol, Warfarin and Scoparone anticoagulants. They found that Scoparone reduced total Cholesterol. Also, were in agree with **Merat and Fallahzadeh (1996)**, who they found a significant decreases in serum total Cholesterol level in the garlic-fed rats. these results are in line with the reports from medical literature which suggests that administration of garlic to

human, rats and cell culture is effective in decreasing Cholesterol. Finally.

These results are in agreement with **El-Mahrouky, (2002)** investigated the effect of different levels of herbicide Machete ($^1/_4$ LD_{50}, ½ LD_{50} and LD_{50}) on Cholesterol in serum of albino Norway rat *R. norvegicus*. The author found that, Cholesterol levels were significantly decreased in serum with all applied herbicide doses.

Table (12): Effect of certain rodenticides on Cholesterol of both sexes of the albino Norway *R. norvegicus* rat after treated.

Rodenticides	Dose	Type of food before treatment											
		Vegetables						Maize and wheat					
		Female			Male			Female			Male		
		Mean ± SE	% of different	Computed T	Mean ± SE	% of different	Computed T	Mean ± SE	% of different	Computed T	Mean ± SE	% of different	Computed T
Brodifacoum	Control	325.6 ± 28.2	-	-	301.28 ± 10.3	-	-	355.6 ± 32.2	-	-	311.28 ± 10.9	-	-
	1/10 LD90	242.0 ± 18.0	-25.7	2.48*	240.7 ± 13.5	-235	3.57*	220.5 ± 13.46	-37.9	3.88**	228.2 ± 10.9	-26.7	4. 37**
	1/10 LD50	268.6 ± 27.1	-17.5	1.44	230.5 ± 23.7	-17.8	1.85	262.0 ± 28.2	-26.3	2.19	257.7 ± 19.4	-17.21	2.4
	1/10 LD30	275.4 ± 23.18	-15.4	1.38	262.5 ± 20.19	-12.88	1.71	302.0 ± 20.2	-15.1	1.41	287.0 ± 16.1	-7.8	1.25
Chlorophacinone	Control	325.6 ± 28.2	-	-	301.28 ± 10.3	-	-	355.6 ± 32.2	-	-	311.28 ± 10.9	-	-
	1/10 LD90	250.0 ± 10.33	-23.2	2.52*	243.17 ± 15.1	-19.28	3.18*	270.6 ± 11.6	-23.9	2.48*	242.2 ± 18.6	-22.16	3.21*
	1/10 LD50	286.5 ± 12.92	-12.0	1.26	257.73 ± 20.9	-17.77	1.87	285.9 ± 10.7	-19.6	2.1	288.4 ± 6.0	-7.35	2.06
	1/10 LD30	298.8 ± 14.2	-8.2	0.84	268.2 ± 25.1	-10.98	1.22	315. ± 12.6	-11.4	1.17	298.7 ± 4.3	-4.04	1.07
Warfarin	Control	325.6 ± 28.2	-	-	301.28 ± 10.3	-	-	355.6 ± 32.2	-	-	311.28 ± 10.9	-	-
	1/10 LD90	290.0 ± 13.3	-10.9	1.14	268.1 ± 14.55	-11.01	1.86	284.5 ± 10.8	-19.9	2.15	281.5 ± 8.0	-9.6	2.2
	1/10 LD50	295.0 ± 12.92	-9.4	0.99	284.1 ± 29.0	-9.1	0.56	301.9 ± 16.9	-15.2	1.49	288.2 ± 10.3	-7.4	1.54
	1/10 LD30	298.0 ± 13.4	-8.2	0.88	293.86 ± 22.9	-2.46	0.29	332.2 ± 11.5	-6.58	0.68	297.2 ± 12.8	-4.2	0.85

* Tabulated T at 5 % = 2.45
** Tabulated T at 1 % = 3.71
d. f. = 6

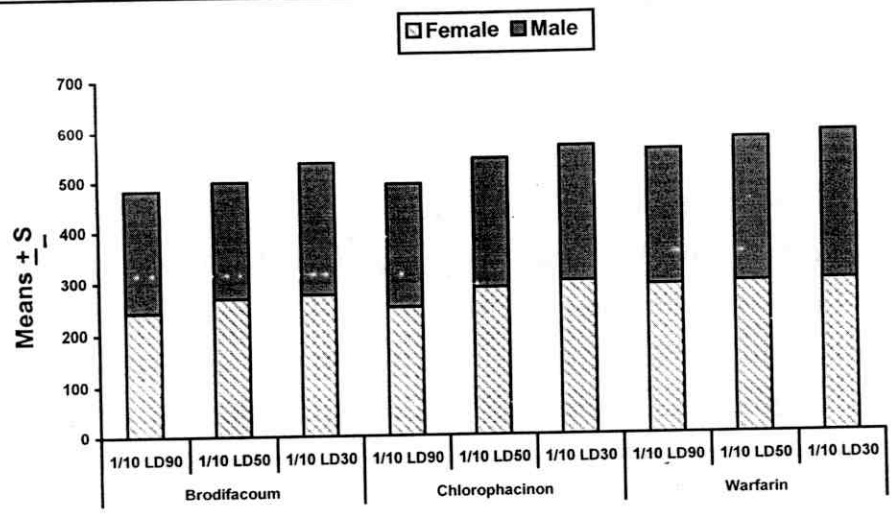


Fig (17): Effect of certain rodenticides on cholestrol of both sexes albino Norway rat *R. norvegicus*, after treated fed vegetables.

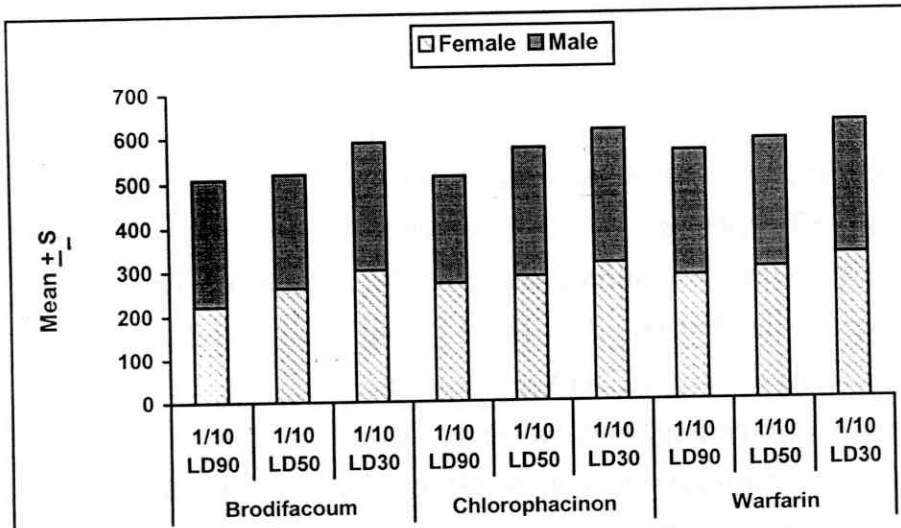


Fig (18): Effect of certain rodenticides on cholestrol of both sexes albino Norway rat *R. norvegicus*, after treated fed maize and wheat.

III-D-Effect of Brodifacoum, Chlorophacinone and Warfarin rodenticides on bleeding time in both sexes of albino Norway rat *R. norvegicus*:-

Data presented in Tables (13, 14, 15) Fig (19) indicated the effect of sublethal doses ($^1/_{10}$ LD_{90}, $^1/_{10}$ $LD_{50}$and $^1/_{10}$ LD_{30}) of the three rodenticides, Brodifacoum, Chlorophacinone and Warfarin on the bleeding time during three periods, 24h, 48h and 72h, where albino Norway rat *R. norvegicus* were fed on maize and wheat. The analysis of variance showed a highly significant difference between treatments, where (F) values were 60.7, 140.5 and 23.6 after 24, 48 and 72h at $^1/_{10}$ LD_{90}, 64.4, 10.5 and 10.2 after 24, 48 and 72h at $^1/_{10}$ LD_{50}. Also, it was observed a highly significant difference between treatments after 24h at sublethal dose ($^1/_{10}$ LD_{30}) Table (15) Fig (19), where (F) value was 11.3, while there was no significant difference after 48 and 72h at the same dose. Also, it noticed that, the effect of these rodenticides on bleeding time, could be arranged according to their effectiveness in a descending order as follows: Brodifacoum > Chlorophacinone > Warfarin. The results presented in Tables (13, 14, 15) Fig (19) clearly show no significant difference between replicates and sexes at the three periods of bleeding time. However, it was observed a significant difference between sexes after 24h of bleeding time at $^1/_{10}$ LD_{50}, which after 48 and 72h, there were no significant difference between sexes.

On the other hand, when albino Norway rat *R. norvegicus* were fed on vegetables, the results revealed the effect of

sublethal doses ($^1/_{10}$ LD_{90}, $^1/_{10}$ LD_{50} and $^1/_{10}$ LD_{30}) of the same rodenticides on the bleeding time during the same periods were a highly significant difference between treatments at the dose $^1/_{10}$ LD_{90}, Table (16) Fig (20) during the three periods, where (F) values were 7.9, 19.4 and 98.7 after 24, 48 and 72h at $^1/_{10}$ LD_{90}, respectively. Also, there was a clear difference in bleeding time at the doses $^1/_{10}$ LD_{50}, $^1/_{10}$ LD_{30} after 48h, while there is no considerable difference between treatments at the doses $^1/_{10}$ LD_{50}, $^1/_{10}$ LD_{30} after 24h, 72h, Tables (17, 18) Fig (20). Also, data in Tables (16, 17, 18) showed that, there were no significant difference between replicated and sexes at the three doses during three periods. Data obtained are similarly those findings by **Gabr, (1997)** who found that, there is no considerable difference between treated rats and control in the first day after treatment, which at the second and third day there was a clear difference in bleeding time between the treated and untreated rats when studied the effectiveness of different doses of investigated anticoagulant an the bleeding time of rats and in contrast to those found by **El-Mahrouky, (1984)** found that bleeding time was greatly increased to about 15 time when albino Norway rat *R. norvegicus* treated with LD_{50} from Brodifacoum in comparison with untreated. Two experiments were carried out to studied the effect of sublethal doses ($^1/_{10}$ LD_{90}, $^1/_{10}$ LD_{50} and $^1/_{10}$ LD_{30}) as three treatments from the rodenticides, Brodifacoum, Chlorophacinone and Warfarin respectively on the bleeding time during three periods, 24h, 48h and 72h, where albino rats were feeding on maize and wheat in the first experiment Tables (19, 20, 21) Fig (21) and fed on vegetables in the second experiment Tables (22, 23, 24) Fig (22). The analysis of variance showed a

highly significant difference between treatments in the two experiments except the Warfarin treatment after 72h. This results may be revealed that all single doses of anticoagulants are more effective against the rats these data were also in can cordance with those for **Ibrahim, (1995),** stated that bleeding time measured before Warfarin treatment to *R. norvegicus* and *R. rattus* exhibited a considerable variation from strain to another. He stated also, that after Warfarin time in strain collected from governorate to another. Also, with those for **Selim *et al.*, (1991)** who found that treatments with medium lethal concentration (LC_{50}) of the anticoagulant Warfarin caused considerable changes in blood picture of the root rats *R. rattus*, and a significant increase in bleeding time were recorded.

Table (13): Mean of bleeding time of the Norway rat *R. norvegicus* (fed on wheat and maize) which treated with $^{1}/_{10}$ LD_{90} of certain rodenticides.

Treatments	Sexes	Mean of bleeding time after			Tabulated F
		24h	48h	72h	
Brodifacoum	Male	167.5	162.5	127.5	
	Female	167.5	161.25	146.25	
Total	Mean	335	323.75	273.75	
Chlorophacinone	Male	171.25	161.25	122.5	
	Female	153.75	132.5	120	
Total	Mean	325	293.75	242.5	
Warfarin	Male	116.25	106.25	83.75	
	Female	120	111.25	107.5	
Total	Mean	236.25	217.5	191.25	
Calculated (F) within	Treatment	60.7	140.5	23.6	5.14
	Rep.	1.12	1.24	0.12	4.76
	Sexes	0.7	3.55	1.13	4.-
L.S.D.	Treatment	17.1	11.32	20.99	
	Rep.	-	-	-	
	Sexes	-	-	-	

Table (14): Mean of bleeding time of the Norway rat *R. norvegicus* (fed on wheat and maize) which treated with $^{1}/_{10}$ LD_{50} of certain rodenticides.

Treatments	Sexes	Mean of bleeding time after			Tabulated F
		24h	48h	72h	
Brodifacoum	Male	167.5	157.5	126.25	
	Female	136.25	130	113.75	
Total	Mean	303.75	287.5	240	
Chlorophacinone	Male	120	121.25	101.25	
	Female	120	113.75	100	
Total	Mean	240	235	201.25	
Warfarin	Male	115	111.25	97.5	
	Female	115	107.5	91.25	
Total	Mean	230	218.75	188.75	
Calculated (F) within	Treatment	64.4	10.5	10.2	5.14
	Rep.	0.78	0.93	1.38	4.76
	Sexes	4.02	0.49	0.36	4.-
L.S.D.	Treatment	11.99	27.13	20.54	
	Rep.	-	-	-	
	Sexes	11.99	-	-	

Table (15): Mean of bleeding time of the Norway rat *R. norvegicus* (fed on wheat and maize) which treated with $^{1}/_{10}$ LD_{30} of certain rodenticides.

Treatments	Sexes	Mean of bleeding time after			Tabulated F
		24h	48h	72h	
Brodifacoum	Male	117.5	107.5	105	
	Female	118.75	123.75	97.5	
Total	Mean	236.25	231.25	202.5	
Chlorophacinone	Male	112.5	102.5	87.5	
	Female	112.5	1.5	96.25	
Total	Mean	225	207.5	183.75	
Warfarin	Male	103.75	96.25	75	
	Female	95	87-5	93-75	
Total	Mean	198.75	183.75	168.75	
Calculated (F) within	Treatment	11.3	3.74	3.25	5.14
	Rep.	0.29	0.34	0.54	4.76
	Sexes	0.73	0.26	0.28	4.-
L.S.D.	Treatment	14.03	-	-	
	Rep.	-	-	-	
	Sexes	-	-	-	

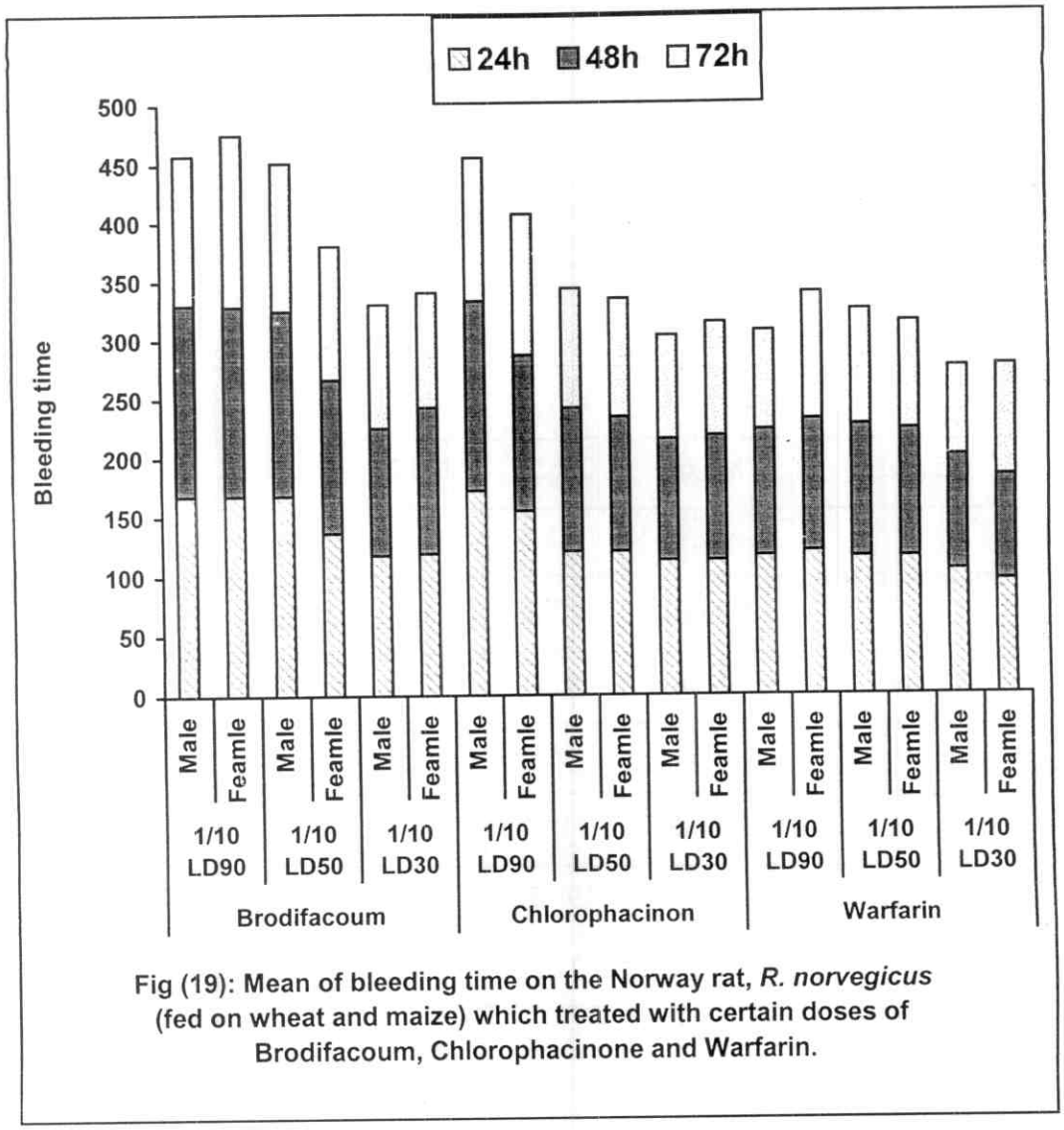


Fig (19): Mean of bleeding time on the Norway rat, *R. norvegicus* (fed on wheat and maize) which treated with certain doses of Brodifacoum, Chlorophacinone and Warfarin.

Table (16): Mean of bleeding time of the Norway rat *R. norvegicus* (vegetable) which treated with $^{1}/_{10}$ LD_{90} of certain rodenticides.

Treatments	Sexes	Mean of bleeding time after			Tabulated F
		24h	48h	72h	
Brodifacoum	Male	108.75	92.5	92.5	
	Female	101.25	90	90	
Total	Mean	210	182.5	182.5	
Chlorophacinone	Male	108	84	60	
	Female	102	84	60	
Total	Mean	210	168	120	
Warfarin	Male	102.5	74.25	60	
	Female	92.5	76	60	
Total	Mean	195	150.25	120	
Calculated (F) within	Treatment	7.99	19.4	98.7	5.14
	Rep.	1.88	1.92	1.-	4.76
	Sexes	2.87	0.85	0.41	4.-
L.S.D.	Treatment	75	8.99	8.9	
	Rep.	-	-	-	
	Sexes	-	-	-	

Table (17): Mean of bleeding time of the Norway rat *R. norvegicus* (vegetable) which treated with $^{1}/_{10}$ LD_{50} of certain rodenticides.

Treatment	Sexes	Mean of bleeding time after			Tabulated F
		24h	48h	72h	
Brodifacoum	Male	85	75	180	
	Female	98.75	68.75	60	
Total	Mean	183.75	143.75	120	
Chlorophacinone	Male	94.5	71.25	60	
	Female	71.5	67.5	60	
Total	Mean	166	138.75	120	
Warfarin	Male	80	67.5	58.75	
	Female	72.5	63.25	58.75	
Total	Mean	152.5	130.75	117.5	
Calculated (F) within	Treatment	3.7	9.79	3.-	5.14
	Rep.	0.69	2.49	1.	4.76
	Sexes	1.42	2.75	1.75	4.-
L.S.D.	Treatment	-	5.13	-	
	Rep.	-	-	-	
	Sexes	-	-	-	

Table (18): Mean of bleeding time of the Norway rat *R. norvegicus* (vegetables) which treated with $^{1}/_{10}$ LD_{30} of certain rodenticides.

Treatment	Sexes	Mean of bleeding time after			Tabulated F
		24h	48h	72h	
Brodifacoum	Male	79	67	53.75	
	Female	71	64	56.25	
Total	Mean	150	131	110	
Chlorophacinone	Male	68.75	64	53.75	
	Female	72.5	64	53.75	
Total	Mean	141.25	128	107.5	
Warfarin	Male	71.5	62.5	53.75	
	Female	66.5	60	52.5	
Total	Mean	138	122.5	106.25	
Calculated (F) within	Treatment	2.53	11.98	0.31	5.14
	Rep.	2.1	3.9	1.52	4.76
	Sexes	1.81	3.25	1.21	4.-
L.S.D.	Treatment	-	3.1	-	
	Rep.	-	-	-	
	Sexes	-	-	-	

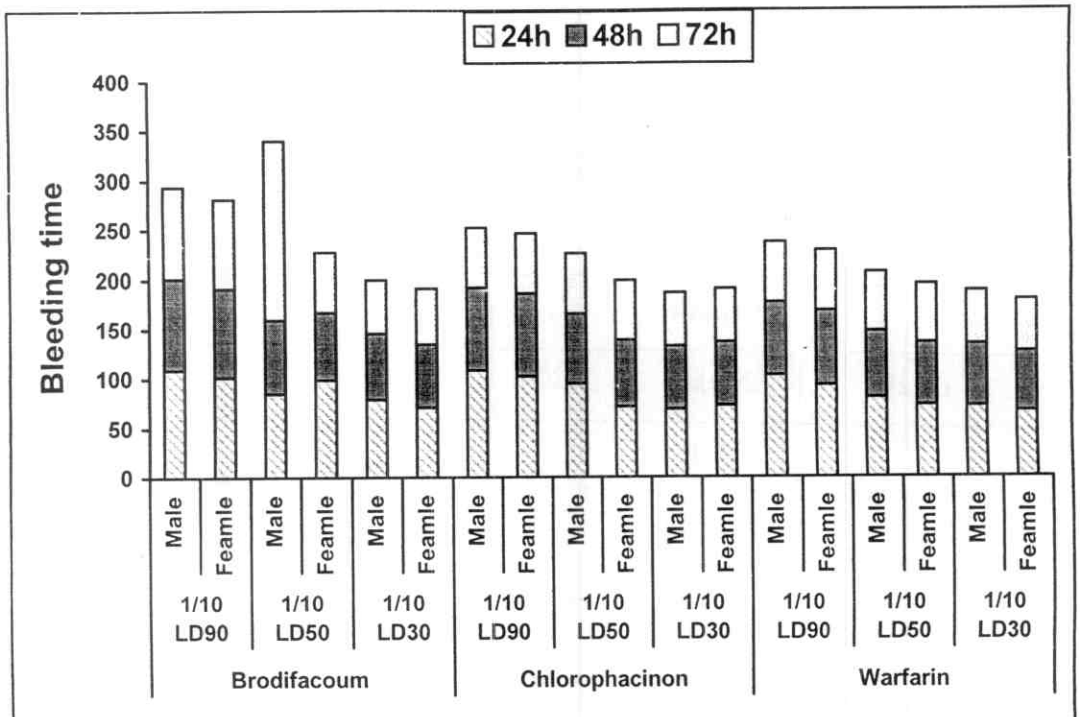


Fig (20): Mean of bleeding time the Norway rat, *R. norvegicus* (vegetables) which treated certain doses of Brodifacoum, Chlorophacinone and Warfarin.

Table (19): Mean of bleeding time of the Norway rat *R. norvegicus* (fed on wheat and maize) which treated with certain doses of Brodifacoum.

Treatments	Sexes	Mean of bleeding time after			Tabulated F
		24h	48h	72h	
$^1/_{10}$ LD_{90}	Male	167.5	162.5	127.5	
	Female	167.5	161.25	146.25	
Total	Mean	335	323.75	273.75	
$^1/_{10}$ LD_{50}	Male	167.5	157.5	126.25	
	Female	136.25	130	113.75	
Total	Mean	303.75	287.5	240	
$^1/_{10}$ LD_{30}	Male	117.5	107.5	1.5	
	Female	118.75	123.75	97.5	
Total	Mean	236.25	231.25	202.5	
Calculated (F) within	Treatment	51.5	10.85	13.14	5.14
	Rep.	0.25	0.003	0.24	4.76
	Sexes	2.32	0.59	1.15	4.-
L.S.D.	Treatment	17.2	34.66	24.1	
	Rep.	-	-	-	
	Sexes	-	-	-	

Table (20): Mean of bleeding time of the Norway rat *R. norvegicus* (fed on wheat and maize) which treated with certain doses of Chlorophacinone.

Treatments	Sexes	Mean of bleeding time after			Tabulated F
		24h	48h	72h	
$^1/_{10}$ LD_{90}	Male	171.25	161.25	122.5	
	Female	153.75	132.5	120	
Total	Mean	325	293.75	242.5	
$^1/_{10}$ LD_{50}	Male	120	121.25	101.25	
	Female	120	113.75	100	
Total	Mean	240	235	201.25	
$^1/_{10}$ LD_{30}	Male	112.5	103.75	87.5	
	Female	112.5	105	96.25	
Total	Mean	225	208.75	183.75	
Calculated (F) within	Treatment	174.5	48.9	141.6	5.14
	Rep.	3.	0.77	2.7	4.76
	Sexes	2.63	3.56	2.46	4.-
L.S.D.	Treatment	10.	15.24	6.2	
	Rep.	-	-	-	
	Sexes	-	-	-	

Table (21): Mean of bleeding time of the Norway rat *R. norvegicus* (fed on wheat and maize) which treated with certain doses of Warfarin.

Treatments	Sexes	Mean of bleeding time after			Tabulated F
		24h	48h	72h	
$^1/_{10}$ LD_{90}	Male	116.25	106.25	83.75	
	Female	120	111.25	107.5	
Total	Mean	236.25	217.5	191.25	
$^1/_{10}$ LD_{50}	Male	115	111.25	97.5	
	Female	115	107.5	91.25	
Total	Mean	230	218.75	188.75	
$^1/_{10}$ LD_{30}	Male	103.75	96.25	75	
	Female	95	87.5	93.75	
Total	Mean	198.75	183.75	168.75	
Calculated (F) within	Treatment	59.69	38.48	1.96	5.14
	Rep.	0.19	1.36	0.79	4.76
	Sexes	2.24	2.98	1.89	4.-
L.S.D.	Treatment	6.54	7.84	-	
	Rep.	-	-	-	
	Sexes	-	-	-	

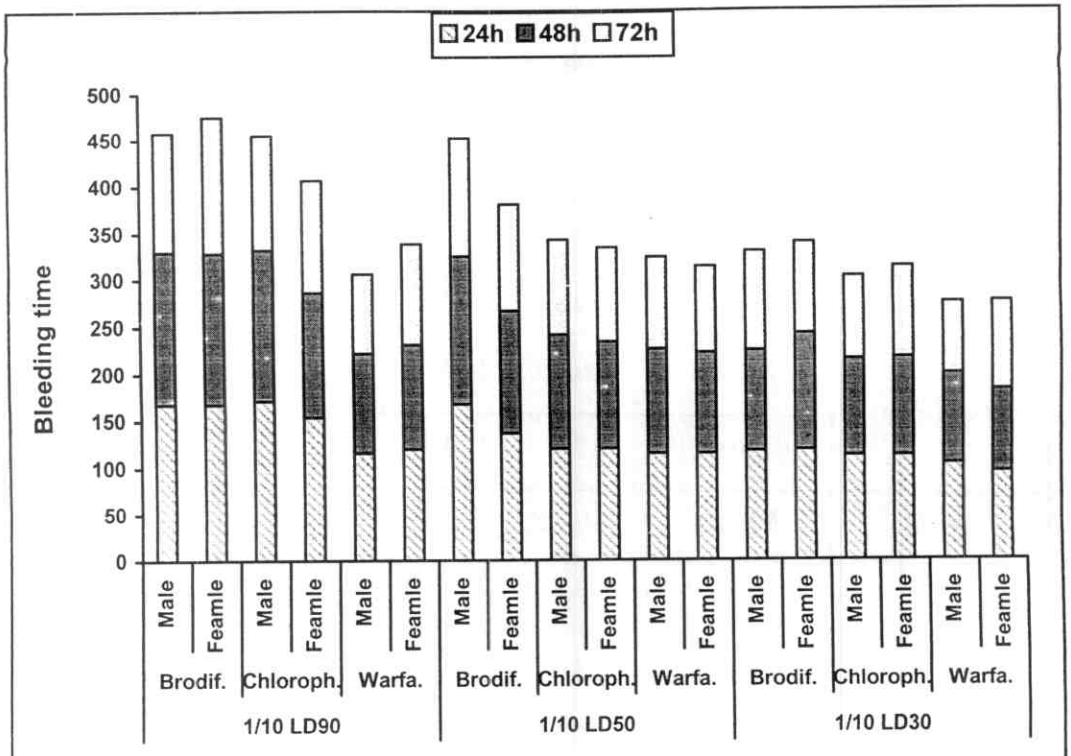


Fig (21): Mean of bleeding time the Norway rat, *R. norvegicus* (fed on wheat and maize) which treated with certain doses of Brodifacoum, Chlorophacinone and Warfarin.

Table (22): Mean of bleeding time of the Norway rat *R. norvegicus* (vegetables) which treated with certain doses of Brodifacoum.

Treatments	Sexes	Mean of bleeding time after			Tabulated F
		24h	48h	72h	
$^1/_{10}$ LD_{90}	Male	108.75	92.5	92.5	
	Female	101.25	90	90	
Total	Mean	210	182.5	182.5	
$^1/_{10}$ LD_{50}	Male	85	75	60	
	Female	98.75	68.75	60	
Total	Mean	183.75	143.75	120	
$^1/_{10}$ LD_{30}	Male	79	67	53.75	
	Female	71	64	65.25	
Total	Mean	150	131	110	
Calculated (F) within	Treatment	20.03	63.92	72.75	5.14
	Rep.	1.75	1.82	0.28	4.76
	Sexes	1.24	1.1	0.29	4.-
L.S.D.	Treatment	16.46	8.22	11.4	
	Rep.	-	-	-	
	Sexes	-	-	-	

Table (23): Mean of bleeding time of the Norway rat *R. norvegicus* (vegetables) which treated with certain doses of Chlorophacinone.

Treatments	Sexes	Mean of bleeding time after			Tabulated F
		24h	48h	72h	
$^1/_{10}$ LD_{90}	Male	108	84	60	
	Female	102	84	60	
Total	Mean	210	168	120	
$^1/_{10}$ LD_{50}	Male	94.5	71.25	60	
	Female	71.5	67.5	60	
Total	Mean	166	138.75	120	
$^1/_{10}$ LD_{30}	Male	68.75	64	53.75	
	Female	72.5	64	53.75	
Total	Mean	141.25	128	107.5	
Calculated (F) within	Treatment	42.2	75.7	74.9	5.14
	Rep.	0.26	0.81	1.	4.76
	Sexes	2.2	0.96	1.75	4.-
L.S.D.	Treatment	13.1	5.8	2.04	
	Rep.	-	-	-	
	Sexes	-	-	-	

Table (24): Mean of bleeding time of the Norway rat *R. norvegicus* (vegetables) which treated with certain doses of Warfarin.

Treatments	Sexes	Mean of bleeding time after			Tabulated F
		24h	48h	72h	
$^1/_{10}$ LD_{90}	Male	102.5	74.25	60	
	Female	92.5	76	60	
Total	Mean	195	150.25	120	
$^1/_{10}$ LD_{50}	Male	80	67.5	58.75	
	Female	72.5	63.25	58.75	
Total	Mean	152.5	130.75	117.5	
$^1/_{10}$ LD_{30}	Male	71.5	62.5	53.75	
	Female	66.5	60	52.5	
Total	Mean	138	122.5	106.25	
Calculated (F) within	Treatment	34.6	44	34.3	5.14
	Rep.	0.2	2.92	2.99	4.76
	Sexes	0.98	2.16	1.75	4.-
L.S.D.	Treatment	12.3	5.26	3.1	
	Rep.	-	-	-	
	Sexes	-	-	-	

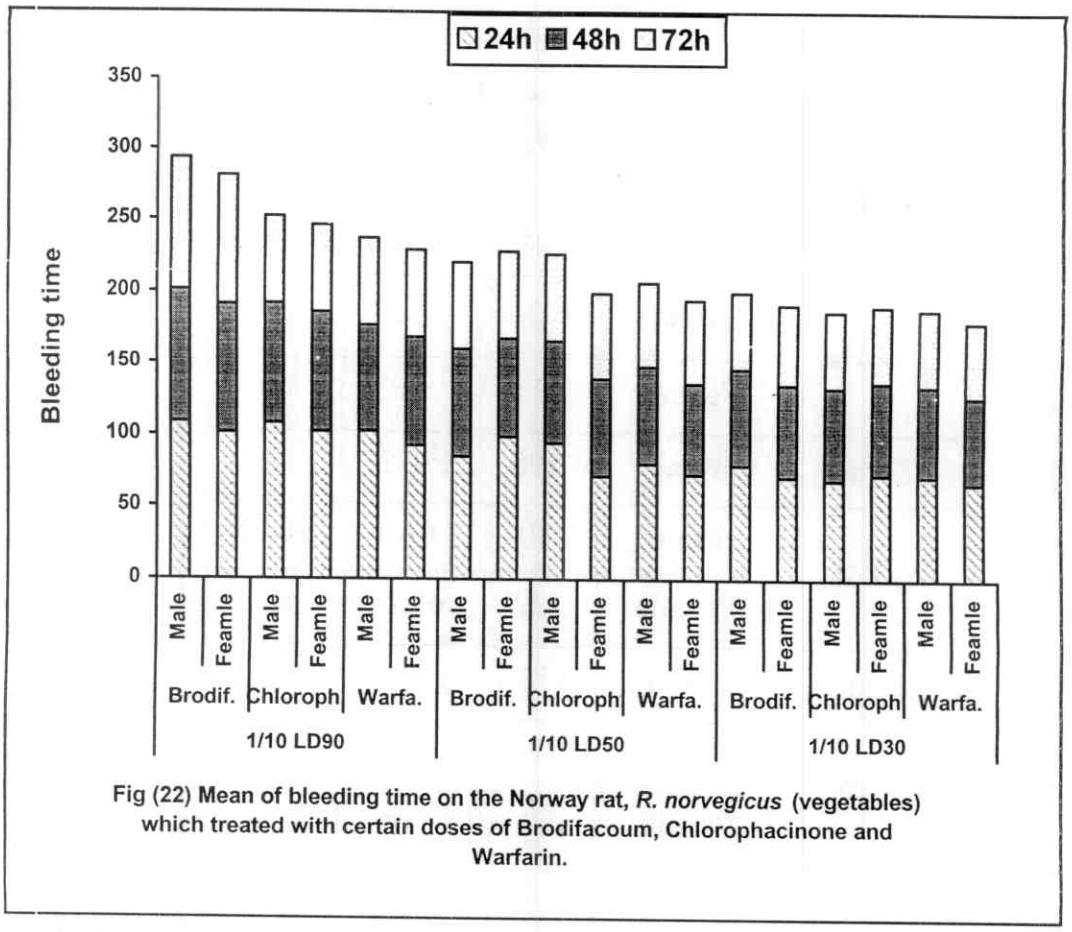


Fig (22) Mean of bleeding time on the Norway rat, *R. norvegicus* (vegetables) which treated with certain doses of Brodifacoum, Chlorophacinone and Warfarin.

IV-Clinical symptoms:-

This part showed that the influence of sublethal doses ($^1/_{10}$ LD_{90}, $^1/_{10}$ LD_{50} and $^1/_{10}$ LD_{30}) of the three rodenticides on the body and certain organs weight in both sexes of albino Norway rat *R. norvegicus* which were fed on maize and wheat in the first experiment and vegetables in the second one. The obtained results revealed that the three rodenticides induced generally a decrease in body weight of the treated albino Norway rat *R. norvegicus* when measured after treatment, then compared with control value in the two experiments. However, there was a highly significant decrease in the body weight when both sexes were treated with Brodifacoum at the sublethal dose $^1/_{10}$ LD_{90} when albino Norway rats were fed on Maize and Wheat while, the effect of Brodifacoum at the same dose gave a significant decrease in the body weight when both sexes were fed on vegetables. Also, similar result was obtained when males of albino Norway rat which were fed on maize and wheat were treated with Chlorophacinone at the same dose. On the same time, female of albino Norway rat which was fed on maize and wheat gave a significant decrease in body weight. Similarly the same result was obtained when both sexes of albino Norway rat which fed on vegetables were treated with Chlorophacinone at the same dose. On the other hand, the effect of Warfarin at $^1/_{10}$ LD_{90} indicated the same trend in the two experiments where as a significant decrease was obtained in case of males and in significant decrease in body weight in case of females. Also, similar observation was recorded with the effect of Brodifacoum at $^1/_{10}$ LD_{50} , where there was a significant decrease in case of

males and non-significant decrease in body weight with the females in the two experiments. But, the effect of Chlorophacinone and Warfarin at $^{1}/_{10}$ LD_{30} and the effect of the three rodenticides in the two experiments were induced non-significant decrease in body weight. The maximum decrease was observed when both males and females were fed on maize and wheat with difference of 7.2 and 6.4% respectively at $^{1}/_{10}$ LD_{90} when treated with Brodifacoum while the minimum decrease was noticed at $^{1}/_{10}$ LD_{30} when females were fed on maize and wheat with difference 0.79% then 0.96% when females fed on vegetables, when treated with Warfarin, respectively. At was clear from the present results that the losses in body weight of male albino Norway rat were more than females after treatment with the three rodenticides. These results may be due to the loss of appetite and the variation of tolerance in both sexes. On the contrary, results indicated that the effect of the three used rodenticides induced an increase in organs weight in general of treated albino Norway rat *R. norvegicus* when measured after treatments, than compared with control value in the two experiments. However, there was a highly significant increase in the liver and kidney weight when males were treated with Brodifacoum at the sublethal dose $^{1}/_{10}$ LD_{90} when albino Norway rat were fed on maize and wheat, while the effect of Brodifacoum at the same dose gave a significant increase in the liver and kidney weight, when females were fed on maize and wheat in the first experiment and when both sexes which fed on Vegetable in the second one. Similarly, the effect of Chlorophacinone at the same dose $^{1}/_{10}$ LD_{90} had shown a significant increase in the liver weight in both sexes in the two

cases of feeding. Also, the same results were obtained when both sexes were fed on maize and wheat after treatment with Warfarin at $^{1}/_{10}$ LD_{90}. But when both sexes of albino rats were fed on vegetables after treated with Warfarin at $^{1}/_{10}$ LD_{90} the results induced non-significant increase in the liver weight. Also, when males which fed on maize and wheat were treated with Chlorophacinone at $^{1}/_{10}$ LD_{90}, there was a highly significant increase in kidney weight, however, females gave a significant increase at the same dose. In the same time, when males were fed on vegetables and treated with Chlorophacinone at $^{1}/_{10}$ LD_{90}, the results induced a significant increase in kidney weight. On the other hand, females were given non-significant increase in kidney weight. On the contrarily, when males were fed on Maize and Wheat and treated with Warfarin at $^{1}/_{10}$ LD_{90}, the results gave a significant increase in kidney weight, but females at the same dose, showed non-significant increase in kidney weight. Also, both sexes of albino Norway rats which fed on vegetables gave non-significant increase in kidney weight. Other trend was observed when both sexes of albino Norway rat which fed on maize and wheat, and treated with Brodifacoum and Chlorophacinone at $^{1}/_{10}$ LD_{50}, indicated a significant increase in liver weight. On the other hand treatment with Warfarin at the same dose, showed non-significant increase in the liver weight. At the same time, when both sexes of albino rats were fed on vegetables, and treated with the three rodenticides at $^{1}/_{10}$ LD_{50}, the results gave non-significant increase in liver weight except for males after treatment with Brodifacoum. Also, the obtained results induced a significant increase in kidney weight of males, fed on maize and wheat after treatment with Brodifacoum and

Chlorophacinone at $^{1}/_{10}$ LD_{50}, while females showed non-significant increase in kidney weight. The same results were observed with Warfarin at the same dose. But, when albino rats fed on vegetables, no significant increase in kidney weight in both sexes was found after the treatment with the three rodenticides except for the males, whereas a significant increase in kidney weight was obtained. The remain organs, reproductive system, spleen, lung, heart and brain showed no significant increase in the weight when compared with the control in the two experiments after treatment with the three rodenticides at $^{1}/_{10}$ LD_{90} and $^{1}/_{10}$ LD_{50}. In the same time, all the organs in the two experiments had shown a significant a slightly increase in weight.

The maximum increase in liver and kidney weight was observed when males were fed on maize and wheat with difference of 21.8% and 22.7% respectively, after treatment with Brodifacoum at $^{1}/_{10}$ LD_{90} , Table (25) Fig (23, 24, 25.) The same results were observed, when males treated with Chlorophacinone at the same dose with difference 18.06% and 22.7% respectively, Table (26) Fig (23, 24, 25). Also, the results indicated the same line, when males were fed on vegetables, whereas the percent of variation was 18.9% and 21.7% Table (28) Fig (24, 25, 26, 27) after Brodifacoum treatment. While it was 17.9%, 22.8% after Chlorophacinone treatment at $^{1}/_{10}$ LD_{90}, Table (29) Fig (24, 25, 26, 27). The minimum increase in liver and kidney weight was noticed at $^{1}/_{10}$ LD_{30} in the two experiments. The clinical symptoms of the three rodenticides against albino Norway rat which fed on maize and wheat noticed in Tables (25,26,27)

Fig (32, 33) in the first experiment and in Tables (28,29,30) Fig (33, 34) when feeding on vegetable in the second one. The internal organs examination showed cloudy and congestion in the liver, kidney and heart. A noticeable darkness colour of spleen, also, an obvious congestion, solidification and bleeding was observed in lung and internal bleeding occurred in testes, uterus and embryos. Finally, bleeding occurred from the front part of the limbs, gradual falling of hair, also, there is no internal or external bleeding. The results effects showed that, the three used rodenticides were doses dependent the higher the dose, the higher the effect was on the various organs of both sexes.

The present results are in agreement with those of **El-Mahrouky, (2002),** who investigated the effect of different levels of herbicide Machete ($^1/_4$ LD_{50}, ½ LD_{50} and LD_{50}) on body weight and liver, kidney weight of albino Norway rat. The author showed a decreases allover the tested doses used in body weight and an increase in liver and kidney weight comparing to control. These results were incordance with those to **Khidr, (2002)** recorded, a significant decrease in body weight, while significant increase was recorded in heart and lung weight comparing with control, when studied the effect of $^1/_4$ LD_{50} of herbicide Machete was investigated, on body, heart and lung weight of albino Norway rat. Similarly, **El-Mahrouky, *et al.*, (2003)** examined the histological changes and some parameters in the kidney of albino rat to show the effect of daily $^1/_4$ LD_{50} of herbicide Machete after 1^{st}, 2^{nd}, 3^{rd} and 4^{th} weeks post treatment. The results indicated a marked significant decrease in body weight, while a significant increase in kidney weight.

The results were in agreed with **Gabr, *et al.*, (2004)** who they studied the rodenticidal effect of Oshar crude plant extract against albino Norway rat *R. norvegicus*. The results of clinical symptoms showed a decrease in body weight of the treated animals, cloudy and congestion liver, kidney and heart, noticeable darkness colour of spleen, also, an obvious congestion and bleeding was observed in the lung.

Table (25): oral toxicity of different doses of 0.1 (LD_{90}, LD_{50} and LD_{30}) from Brodifacoum On various organs of both sexes of albino rats, which were fed on maize , wheat.

Dose	Organs	Mean weight / g ± S.E								Clinical symptoms
		Male				Female				
		Untreated	Treated	% of different	T computed	Untreated	Treated	% of different	T computed	
0.1 of LD_{90}	Body	252.5 ± 3.3	2.34 ± 2.7	-7.2	4.20**	238.5 ± 2.8	223.1 ± 2.4	-6.4	4.18**	Reduced of body weight
	Liver	5.86 ± 0.26	7.14 ± 0.13	21.8	4.4**	5.63 ± 0.06	6.51 ± 0.25	15.6	3.52*	Cloudy and congestion
	Kidney	1.98 ± 0.10	2.43 ± 0.04	22.7	4.2**	1.86 ± 0.04	2.13 ± 0.09	15.6	2.5*	Congestion and bleeding
	Reproductive system	3.28 ± 0.06	3.67 ± 0.12	11.9	2.06*	2.66 ± 0.01	2.87 ± 0.08	7.9	1.91*	Internal bleeding in testes, uterus and Embryos
	Spleen	1.04 ± 0.04	1.12 ± 0.04	7.7	1.24	0.88 ± 0.02	0.92 ± 0.03	4.5	1.33	Darkness colour
	Lung	1.34 ± 0.08	1.46 ± 0.008	8.9	1.5	1.22 ± 0.13	1.29 ± 0.04	5.7	0.54	Bleeding congestion and soliclification
	Heart	1.46 ± 0.03	1.46 ± 0.05	2.05	0.6	1.31 ± 0.15	1.38 ± 0.01	5.3	0.47	Cloudy, congestion and bleeding
	Brain	1.42 ± 0.05	1.45 ± 0.06	2.1	0.42	1.36 ± 0.04	1.41 ± 0.008	3.7	1.25	Congestion and bleeding
0.1 of LD_{50}	Body	252.5 ± 3.3	239.1 ± 2.4	-5.3	3.28*	238.5 ± 2.8	233.2 ± 2.1	-2.2	1.51	Reduced of body weight
	Liver	5.86 ± 0.26	6.62 ± 0.17	12.9	2.45*	5.63 ± 0.06	6.02 ± 0.64	7.05	2.6*	Cloudy and congestion
	Kidney	1.98 ± 0.10	2.23 ± 0.02	12.6	2.45*	1.86 ± 0.04	2.01 ± 0.04	8.1	1.66	Congestion and bleeding
	Reproductive system	3.28 ± 0.06	3.52 ± 0.39	7.3	0.62	2.66 ± 0.01	2.7 ± 0.04	1.8	1.0	Internal bleeding in testes, and Embryos
	Spleen	1.04 ± 0.04	1.08 ± 0.02	3.8	1.0	0.88 ± 0.02	0.9 ± 0.06	2.9	0.33	Darkness colour
	Lung	1.34 ± 0.08	1.4 ± 0.03	4.4	0.75	1.22 ± 0.13	1.25 ± 0.13	3.1	0.17	Bleeding and congestion
	Heart	1.46 ± 0.1	1.4 ± 0.04	0.68	0.1	1.31 ± 0.15	1.34 ± 0.02	2.5	0.2	Cloudy, congestion and bleeding
	Brain	1.42 ± 0.05	1.43 ± 0.05	0.7	0.14	1.36 ± 0.04	1.4 ± 0.03	3.2	0.8	Congestion
0.1 of LD_{30}	Body	252.5 ± 3.3	248.2 ± 2.8	-1.7	1.0	238.5 ± 2.8	235.4 ± 2.3	-1.29	0.86	Slight reduction weight
	Liver	5.86 ± 0.26	5.95 ± 0.22	1.5	0.26	5.63 ± 0.06	5.67 ± 0.06	0.71	0.5	Congestion
	Kidney	1.98 ± 0.10	2.04 ± 0.05	3.03	0.54	1.86 ± 0.04	1.88 ± 0.05	1.07	0.33	Congestion
	Reproductive system	3.28 ± 0.06	3.29 ± 0.06	0.3	0.13	2.66 ± 0.01	2.67 ± 0.02	0.37	0.5	-
	Spleen	1.04 ± 0.04	1.05 ± 0.04	1	0.2	0.88 ± 0.02	0.89 ± 0.01	1.13	0.45	Congestion
	Lung	1.34 ± 0.08	1.36 ± 0.008	1.6	0.25	1.22 ± 0.13	1.23 ± 0.13	0.81	0.06	Congestion
	Heart	1.46 ± 0.13	1.462 ± 0.04	0.2	0.02	1.31 ± 0.15	1.32 ± 0.05	0.76	0.07	-
	Brain	1.42 ± 0.05	1.43 ± 0.05	0.7	0.14	1.36 ± 0.04	1.37 ± 0.01	0.73	0.25	-

Table (26): oral toxicity of different doses of 0.1 (LD_{90}, LD_{50} and LD_{30}) from Chlorophacinone on various organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on maize , wheat.

Dose	Organs	Mean weight / g ± S.E								Clinical symptoms
		Male				Female				
		Untreated	Treated	% of different	T computed	Untreated	Treated	% of different	T computed	
0.1 of LD_{90}	Body	224.4 ± 2.6	210.8 ± 2.1	-6.06	4.07**	209.5 ± 2.3	202.1 ± 2.0	-3.53	2.47*	Reduced of body weight
	Liver	5.48 ± 0.13	6.47 ± 0.25	18.06	3.53*	5.22 ± 0.06	5.89 ± 0.26	12.8	2.55*	Cloudy and congestion
	Kidney	1.85 ± 0.10	2.27 ± 0.03	22.7	4.03**	1.76 ± 0.01	1.97 ± 0.08	11.93	2.63*	Congestion and bleeding
	Reproductive system	3.1 ± 0.05	3.48 ± 0.13	12.25	1.94	2.6 ± 0.02	2.81 ± 0.01	8.07	1.91	Internal bleeding in testes, uterus and Embryos
	Spleen	1.02 ± 0.06	1.07 ± 0.15	4.9	0.31	0.94 ± 0.13	0.99 ± 0.01	5.13	0.38	Darkness colour
	Lung	1.22 ± 0.08	1.32 ± 0.13	8.19	0.67	1.12 ± 0.13	1.17 ± 0.13	4.46	0.28	Bleeding congestion and soliclification
	Heart	1.37 ± 0.01	1.38 ± 0.01	0.73	0.71	1.21 ± 0.01	1.26 ± 0.14	4.13	0.36	Cloudy, congestion and bleeding
	Brain	1.35 ± 0.02	1.39 ± 0.02	2.96	1.42	1.31 ± 0.05	1.36 ± 0.01	3.8	0.98	Congestion and bleeding
0.1 of LD_{50}	Body	224.4 ± 2.6	219.2 ± 2.3	-2.3	1.49	209.5 ± 2.3	205.8 ± 2.2	-1.76	1.16	Reduced of body weight
	Liver	5.48 ± 0.13	6.7 ± 0.19	11.3	2.19*	5.22 ± 0.06	5.53 ± 0.11	5.9	2.65*	Cloudy and congestion
	Kidney	1.85 ± 0.10	2.07 ± 0.01	11.9	2.5*	1.76 ± 0.01	1.89 ± 0.08	7.39	1.63	Congestion and bleeding
	Reproductive system	3.1 ± 0.05	3.26 ± 0.03	5.16	1.6*	2.6 ± 0.02	2.67 ± 0.13	2.69	0.54	Internal bleeding in testes, and Embryos
	Spleen	1.02 ± 0.06	1.05 ± 0.05	2.94	0.44	0.94 ± 0.13	0.96 ± 0.001	2.1	0.15	Darkness colour
	Lung	1.22 ± 0.08	1.26 ± 0.07	3.27	0.38	1.12 ± 0.13	1.15 ± 0.02	2.67	0.23	Bleeding and congestion
	Heart	1.37 ± 0.01	1.41 ± 0.05	2.91	0.8	1.21 ± 0.01	1.24 ± 0.03	2.47	0.96	Cloudy, congestion and bleeding
	Brain	1.35 ± 0.02	1.39 ± 0.04	2.96	0.91	1.31 ± 0.05	1.34 ± 0.04	2.29	0.47	Congestion
0.1 of LD_{30}	Body	224.4 ± 2.6	221.3 ± 2.2	-1.38	0.91	209.5 ± 2.3	207.4 ± 3.3	-1.002	0.52	Slight reduction weight
	Liver	5.48 ± 0.13	5.56 ± 0.14	1.45	0.42	5.22 ± 0.06	5.26 ± 0.14	5.76	0.28	Congestion
	Kidney	1.85 ± 0.10	1.91 ± 0.03	3.2	0.58	1.76 ± 0.01	1.78 ± 0.15	1.13	0.13	Congestion
	Reproductive system	3.1 ± 0.05	3.11 ± 0.04	0.32	0.16	2.6 ± 0.02	2.61 ± 0.01	0.38	0.45	-
	Spleen	1.02 ± 0.06	1.04 ± 0.04	1.96	0.28	0.94 ± 0.13	0.94 ± 0.01	0.1	0.008	Congestion
	Lung	1.22 ± 0.08	1.23 ± 0.01	0.81	0.13	1.12 ± 0.13	1.13 ± 0.05	0.89	.0.2	Congestion
	Heart	1.37 ± 0.01	1.38 ± 0.01	0.72	0.71	1.21 ± 0.01	1.22 ± 0.02	0.82	0.45	-
	Brain	1.35 ± 0.02	1.36 ± 0.03	0.74	0.28	1.31 ± 0.05	1.32 ± 0.03	0.76	0.17	-

Table (27): oral toxicity of different doses of 0.1 (LD_{90}, LD_{50} and LD_{30}) from Warfarin On various organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on maize , wheat.

Dose	Organs	Mean weight / g ± S.E								Clinical symptoms
		Male				Female				
		Untreated	Treated	% of different	T computed	Untreated	Treated	% of different	T computed	
0.1 of LD_{90}	Body	246.2 ± 3.1	2333.2 ± 2.4	-5.28	3.32*	212.6 ± 2.1	207.5 ± 2.2	-2.4	1.68	Reduced of body weight
	Liver	5.56 ± 0.21	6.23 ± 0.14	12.05	2.66*	5.27 ± 0.02	5.74 ± 0.17	8.91	2.57*	Cloudy and congestion
	Kidney	2.01 ± 0.06	2.24 ± 0.06	11.44	2.73*	1.99 ± 0.01	2.16 ± 0.14	8.7	1.21	Congestion and bleeding
	Reproductive system	3.32 ± 0.13	3.52 ± 0.02	6.02	1.53	2.55 ± 0.13	2.66 ± 0.13	4.6	0.6	Internal bleeding in testes, uterus and Embryos
	Spleen	1.18 ± 0.14	1.22 ± 0.05	3.38	0.31	1.06 ± 0.06	1.09 ± 0.02	3.4	0.48	Darkness colour
	Lung	1.3 ± 0.07	1.34 ± 0.03	3.07	0.47	1.11 ± 0.05	1.16 ± 0.02	4.8	0.94	Bleeding congestion and soliclification
	Heart	1.41 ± 0.04	1.42 ± 0.01	0.7	0.24	1.26 ± 0.03	1.3 ± 0.03	3.2	0.93	Cloudy, congestion and bleeding
	Brain	1.37 ± 0.01	1.39 ± 0.01	1.45	1.43	1.32 ± 0.02	1.35 ± 0.01	2.9	1.36	Congestion and bleeding
0.1 of LD_{50}	Body	246.2 ± 3.1	240.7 ± 2.1	*2.23	1.47	212.6 ± 2.1	208.9 ± 2.3	-1.74	1.19	Reduced of body weight
	Liver	5.56 ± 0.21	5.88 ± 0.08	5.75	1.45	5.27 ± 0.02	5.51 ± 0.19	4.55	1.26	Cloudy and congestion
	Kidney	2.01 ± 0.06	2.1 ± 0.06	4.47	1.07	1.99 ± 0.01	2.08 ± 0.15	4.52	0.6	Congestion and bleeding
	Reproductive system	3.32 ± 0.13	3.42 ± 0.06	3.01	0.69	2.55 ± 0.13	2.60 ± 0.06	1.96	0.35	Internal bleeding in testes, and Embryos
	Spleen	1.18 ± 0.14	1.2 ± 0.05	1.69	0.14	1.06 ± 0.06	1.08 ± 0.01	1.88	0.33	Darkness colour
	Lung	1.3 ± 0.07	1.32 ± 0.04	1.53	0.25	1.11 ± 0.05	1.13 ± 0.02	1.8	0.37	Bleeding and congestion
	Heart	1.41 ± 0.04	1.42 ± 0.03	0.7	0.2	1.26 ± 0.03	1.28 ± 0.01	1.58	0.63	Cloudy, congestion and bleeding
	Brain	1.37 ± 0.01	1.38 ± 0.01	0.72	0.71	1.32 ± 0.02	1.33 ± 0.03	0.75	0.28	Congestion
0.1 of LD_{30}	Body	246.2 ± 3.1	243 ± 2.3	-1.29	0.83	212.6 ± 2.1	210.9 ± 2.1	0.79	0.57	Slight reduction weight
	Liver	5.56 ± 0.21	5.63 ± 0.15	1.25	0.28	5.27 ± 0.02	5.32 ± 0.15	0.94	0.33	Congestion
	Kidney	2.01 ± 0.06	2.04 ± 0.13	1.49	0.21	1.99 ± 0.01	2.01 ± 0.06	1.005	0.33	Congestion
	Reproductive system	3.32 ± 0.13	3.33 ± 0.02	0.3	0.08	2.55 ± 0.13	2.56 ± 0.08	0.39	0.07	-
	Spleen	1.18 ± 0.14	1.19 ± 0.01	0.84	0.07	1.06 ± 0.06	1.07 ± 0.02	0.94	0.16	Congestion
	Lung	1.3 ± 0.07	1.31 ± 0.01	0.76	0.14	1.11 ± 0.05	1.12 ± 0.3	09	0.17	Congestion
	Heart	1.41 ± 0.04	1.41 ± 0.02	-	0	1.26 ± 0.03	1.25 ± 0.01	-	0	-
	Brain	1.37 ± 0.01	1.38 ± 0.03	0.72	0.32	1.32 ± 0.02	1.32 ± 0.02	-	0	-

Table (28): oral toxicity of different doses of 0.1 (LD_{90}, LD_{50} and LD_{30}) from Brodifacoum On various organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on vegetables.

Dose	Organs	Mean weight / g ± S.E								Clinical symptoms
		Male				Female				
		Untreated	Treated	% of different	T computed	Untreated	Treated	% of different	T computed	
0.1 of LD_{90}	Body	206.7 ± 2.8	195 ± 3.2	-5.7	2.61*	205.3 ± 2.4	197.1 ± 2.2	-3.9	2.47*	Reduced of body weight
	Liver	5.6 ± 0.22	6.66 ± 0.31	18.9	2.79*	5.36 ± 0.27	0.06 ± 0.12	13.05	2.89*	Cloudy and congestion
	Kidney	2.03 ± 0.09	2.47 ± 0.13	21.7	2.78*	1.82 ± 0.08	2.07 ± 0.05	13.7	2.66*	Congestion and bleeding
	Reproductive system	3.75 ± 0.08	4.16+ ± 0.12	10.9	2.29	2.59 ± 0.15	2.79 ± 0.04	7.7	1.29	Internal bleeding in testes, uterus and Embryos
	Spleen	1.15 ± 0.06	1.24 ± 0.04	6.9	1.14	0.96 ± 0.05	1.0 ± 0.04	4.2	0.63	Darkness colour
	Lung	1.27 ± 0.13	1.36 ± 0.08	7.7	0.59	1.04 ± 0.15	1.1 ± 0.03	5.7	0.39	Bleeding congestion and soliclification
	Heart	1.4 ± 0.11	1.43 ± 0.07	2.1	0.23	1.27 ± 0.06	1.34 ± 0.02	5.5	1.16	Cloudy, congestion and bleeding
	Brain	1.39 ± 0.05	1.44 ± 0.02	3.6	0.93	1.32 ± 0.04	1.39 ± 0.11	5.3	0.58	Congestion and bleeding
0.1 of LD_{50}	Body	206.7 ± 2.8	197.5 ± 2.5	-4.5	2.53*	205.3 ± 2.4	199 ± 2.1	-2.97	1.98	Reduced of body weight
	Liver	5.6 ± 0.22	6.23 ± 0.13	11.25	2.47*	5.36 ± 0.27	5.69 ± 0.08	6.15	1.47	Cloudy and congestion
	Kidney	2.03 ± 0.09	2.27 ± 0.03	11.8	2.53*	1.82 ± 0.08	1.96 ± 0.06	7.69	1.4	Congestion and bleeding
	Reproductive system	3.75 ± 0.08	3.96 ± 0.03	5.6	2.23	2.59 ± 0.15	2.66 ± 0.04	2.7	0.45	Internal bleeding in testes, and Embryos
	Spleen	1.15 ± 0.06	1.02 ± 0.08	3.4	0.4	0.96 ± 0.05	0.99 ± 0.12	3.1	1.23	Darkness colour
	Lung	1.27 ± 0.13	1.33 ± 0.06	4.7	0.42	1.04 ± 0.15	1.08 ± 0.11	3.8	1.22	Bleeding and congestion
	Heart	1.4 ± 0.11	1.42 ± 0.15	1.43	0.11	1.27 ± 0.06	1.32 ± 0.03	3.9	0.07	Cloudy, congestion and bleeding
	Brain	1.39 ± 0.05	1.43 ± 0.08	4.0	0.43	1.32 ± 0.04	1.37 ± 0.008	3.7	1.25	Congestion
0.1 of LD_{30}	Body	206.7 ± 2.8	203 ± 3.6	-1.8	0.8	205.3 ± 2.4	203.1 ± 1.8	-1.07	0.73	Slight reduction weight
	Liver	5.6 ± 0.22	5.69 ± 0.11	1.6	0.38	5.36 ± 0.27	5.4 ± 0.24	0.74	0.13	Congestion
	Kidney	2.03 ± 0.09	2.1 ± 0.03	3.4	0.24	1.82 ± 0.08	1.84 ± 0.16	1.09	0.11	Congestion
	Reproductive system	3.75 ± 0.08	3.77 ± 0.06	0.5	0.2	2.59 ± 0.15	2.6 ± 0.11	0.38	0.05	-
	Spleen	1.15 ± 0.06	1.17 ± 0.13	0.9	0.07	0.96 ± 0.05	0.97 ± 0.03	1.04	0.17	Congestion
	Lung	1.27 ± 0.13	1.29 ± 0.11	1.5	0.12	1.04 ± 0.15	1.05 ± 0.06	0.96	0.31	Congestion
	Heart	1.4 ± 0.11	1.4 ± 0.8	0	0	1.27 ± 0.06	1.28 ± 0.08	0.78	0.1	-
	Brain	1.39 ± 0.05	1.4 ± 0.04	0.7	0	1.32 ± 0.04	1.33 ± 0.05	0.75	0.17	-

Table (29): oral toxicity of different doses of 0.1 (LD_{90}, LD_{50} and LD_{30}) from Chlorophacinone On various organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on vegetables.

Dose	Organs	Mean weight / g ± S.E								Clinical symptoms
		Male				Female				
		Untreated	Treated	% of different	T computed	Untreated	Treated	% of different	T computed	
0.1 of LD_{90}	Body	235 ± 3.2	222.5 ± 3.6	-5.3	2.6*	220 ± 2.9	210.3 ± 2.4	-4.4	2.58*	Reduced of body weight
	Liver	7.12 ± 0.32	8.4 ± 0.29	17.9	2.96*	5.4 ± 0.21	6.1 ± 0.12	12.9	2.92*	Cloudy and congestion
	Kidney	2.28 ± 0.19	2.8 ± 0.06	22.8	2.61*	1.51 ± 0.22	1.71 ± 0.06	13.2	0.88	Congestion and bleeding
	Reproductive system	4.85 ± 0.08	5.4 ± 0.19	11.3	2.2	2.34 ± 0.21	2.51 0.04	7.3	0.79	Internal bleeding in testes, uterus and Embryos
	Spleen	1.57 ± 0.06	1.65 ± 0.07	5.1	0.87	0.89 ± 0.05	0.94 ± 0.01	5.6	1.0	Darkness colour
	Lung	1.61 ± 0.13	1.75 ± 0.05	8.7	1.0	1.82 ± 0.12	1.92 ± 0.03	5.4	0.81	Bleeding congestion and soliclification
	Heart	1.63 ± 0.13	1.82 ± 0.03	11.6	1.43	1.04 ± 0.15	1.1 ± 0.03	5.4	0.39	Cloudy, congestion and bleeding
	Brain	1.86 ± 0.05	1.94 ± 0.14	4.3	0.54	1.23 ± 0.04	1.31 ± 0.11	5.2	0.67	Congestion and bleeding
0.1 of LD_{50}	Body	235 ± 3.2	230 ± 2.5	-2.13	1.33	220 ± 2.9	215.4 ± 2.3	-2.1	1.24	Reduced of body weight
	Liver	7.12 ± 0.32	7.9 ± 0.08	10.9	2.36	5.4 ± 0.21	5.72 ± 0.04	5.9	1.49	Cloudy and congestion
	Kidney	2.28 ± 0.19	2.6 ± 0.07	14.04	1.58	1.51 ± 0.22	1.63 ± 0.19	7.9	0.41	Congestion and bleeding
	Reproductive system	4.85 ± 0.08	5.1 ± 0.13	5.2	1.63	2.34 ± 0.21	2.4 ± 0.17	2.6	0.22	Internal bleeding in testes, and Embryos
	Spleen	1.57 ± 0.06	1.62 ± 0.06	3.2	0.63	0.89 ± 0.05	0.91 ± 0.14	2.2	0.14	Darkness colour
	Lung	1.61 ± 0.13	1.69 ± 0.05	4.9	0.58	1.82 ± 0.12	1.88 ± 0.11	3.3	0.37	Bleeding and congestion
	Heart	1.63 ± 0.13	1.7 ± 0.04	4.3	0.51	1.04 ± 0.15	1.08 ± 0.05,	3.8	0.25	Cloudy, congestion and bleeding
	Brain	1.86 ± 0.05	1.9 ± 0.15	4.0	0.25	1.23 ± 0.04	1.29 ± 0.11	4.9	0.5	Congestion
0.1 of LD_{30}	Body	235 ± 3.2	231.2 ± 2.4	-1.6	0.95	220 ± 2.9	217.1 ± 2.1	-1.3	0.81	Slight reduction weight
	Liver	7.12 ± 0.32	7.23 ± 0.09	1.5	0.33	5.4 ± 0.21	5.44 ± 0.09	0.7	0.18	Congestion
	Kidney	2.28 ± 0.19	2.36 ± 0.05	3.5	0.4	1.51 ± 0.22	1.53 ± 0.06	1.3	0.09	Congestion
	Reproductive system	4.85 ± 0.08	4.86 ± 0.04	0.2	0.11	2.34 ± 0.21	2.35 ± 0.14	0.4	0.4	-
	Spleen	1.57 ± 0.06	1.06 ± 0.06	3	0.36	0.89 ± 0.05	0.89 ± 0.01	0.11	0.02	Congestion
	Lung	1.61 ± 0.13	1.62 ± 0.08	0.6	0.07	1.82 ± 0.12	1.84 ± 0.15	1.1	0.1	Congestion
	Heart	1.63 ± 0.13	1.65 ± 0.07	1.2	0.14	1.04 ± 0.15	1.05 ± 0.08	0.9	0.06	-
	Brain	1.86 ± 0.05	1.88 ± 0.01	1.1	0.4	1.23 ± 0.04	1.24 ± 0.05	0.8	0.16	-

Table (30): oral toxicity of different doses of 0.1 (LD_{90}, LD_{50} and LD_{30}) from Warfarin On various organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on vegetables.

Dose	Organs	Mean weight / g ± S.E								Clinical symptoms
		Male				Female				
		Untreated	Treated	% of different	T computed	Untreated	Treated	% of different	T computed	
0.1 of LD_{90}	Body	215.2 ± 3.1	204.2 ± 2.9	-5.1	2.53*	208.4 ± 3.8	203.4 ± 3.5	-2.3	1.75	Reduced of body weight
	Liver	6.36 ± 0.26	7.1 ± 0.02	11.6	2.24	5.72 ± 0.21	6.23 ± 0.1	8.9	2.22	Cloudy and congestion
	Kidney	2.14 ± 0.29	2.39 ± 0.22	11.7	0.69	2.04 ± 0.22	2.21 ± 0.05	8.5	0.75	Congestion and bleeding
	Reproductive system	4.25 ± 0.08	4.51 ± 0.14	6.12	1.61	3.82 ± 0.21	3.99 ± 0.04	4.5	0.81	Internal bleeding in testes, uterus and Embryos
	Spleen	1.37 ± 0.06	1.42 ± 0.05	3.6	0.64	1.18 ± 0.05	1.22 ± 0.004	3.39	0.8	Darkness colour
	Lung	1.44 ± 0.13	1.49 ± 0.08	3.4	0.33	1.26 ± 0.12	1.32 ± 0.006	4.7	0.5	Bleeding congestion and soliclification
	Heart	1.52 ± 0.13	1.56 ± 0.02	1.32	0.15	1.48 ± 0.15	1.53 ± 0.005	3.4	0.33	Cloudy, congestion and bleeding
	Brain	1.62 ± 0.05	1.65 ± 0.008	1.9	0.6	1.54 ± 0.04	1.59 ± 0.004	3.2	1.25	Congestion and bleeding
0.1 of LD_{50}	Body	215.2 ± 3.1	210.5 ± 2.3	-2.18	1.22	208.4 ± 3.8	205.2 ± 3.2	-1.53	0.74	Reduced of body weight
	Liver	6.36 ± 0.26	6.72 ± 0.17	5.7	0.16	5.72 ± 0.21	5.98 ± 0.09	4.5	1.4	Cloudy and congestion
	Kidney	2.14 ± 0.29	2.24 ± 0.02	4.7	0.34	2.04 ± 0.22	2.14 ± 0.16	4.9	0.37	Congestion and bleeding
	Reproductive system	4.25 ± 0.08	4.38 ± 0.39	3.1	0.33	3.82 ± 0.21	3.9 ± 0.04	2.09	0.37	Internal bleeding in testes, and Embryos
	Spleen	1.37 ± 0.06	1.4 ± 0.14	2.2	0.19	1.18 ± 0.05	1.21 ± 0.09	2.5	0.29	Darkness colour
	Lung	1.44 ± 0.13	1.47 ± 0.01	2.08	0.23	1.26 ± 0.12	1.29 ± 0.004	2.38	0.25	Bleeding and congestion
	Heart	1.52 ± 0.13	1.53 ± 0.01	0.65	0.08	1.48 ± 0.15	1.51 ± 0.02	2.0	0.19	Cloudy, congestion and bleeding
	Brain	1.62 ± 0.05	1.64 ± 0.02	1.23	0.38	1.54 ± 0.04	1.56 ± 0.002	1.3	0.5	Congestion
0.1 of LD_{30}	Body	215.2 ± 3.1	212.6 ± 2.2	-1.21	0.68	208.4 ± 3.8	206.2 ± 4.0	-0.96	0.5	Slight reduction weight
	Liver	6.36 ± 0.26	6.44 ± 0.13	1.25	0.28	5.72 ± 0.21	5.76 ± 0.15	0.69	0.15	Congestion
	Kidney	2.14 ± 0.29	2.18 ± 0.04	1.87	0.14	2.04 ± 0.22	2.06 ± 0.02	0.98	0.9	Congestion
	Reproductive system	4.25 ± 0.08	4.2 ± 0.02	0.47	0.09	3.82 ± 0.21	3.82 ± 0.04	0.26	0.05	-
	Spleen	1.37 ± 0.06	1.38 ± 0.04	0.73	0.14	1.18 ± 0.05	1.19 ± 0.03	0.84	0.17	Congestion
	Lung	1.44 ± 0.13	1.45 ± 0.008	0.69	0.07	1.26 ± 0.12	1.27 ± 0.005	0.79	0.08	Congestion
	Heart	1.52 ± 0.13	1.52 ± 0.04	-	0	1.48 ± 0.15	1.48 ± 0.004	-	0	-
	Brain	1.62 ± 0.05	1.62 ± 0.005	-	0	1.54 ± 0.04	1.54 ± 0.004	-	0	-

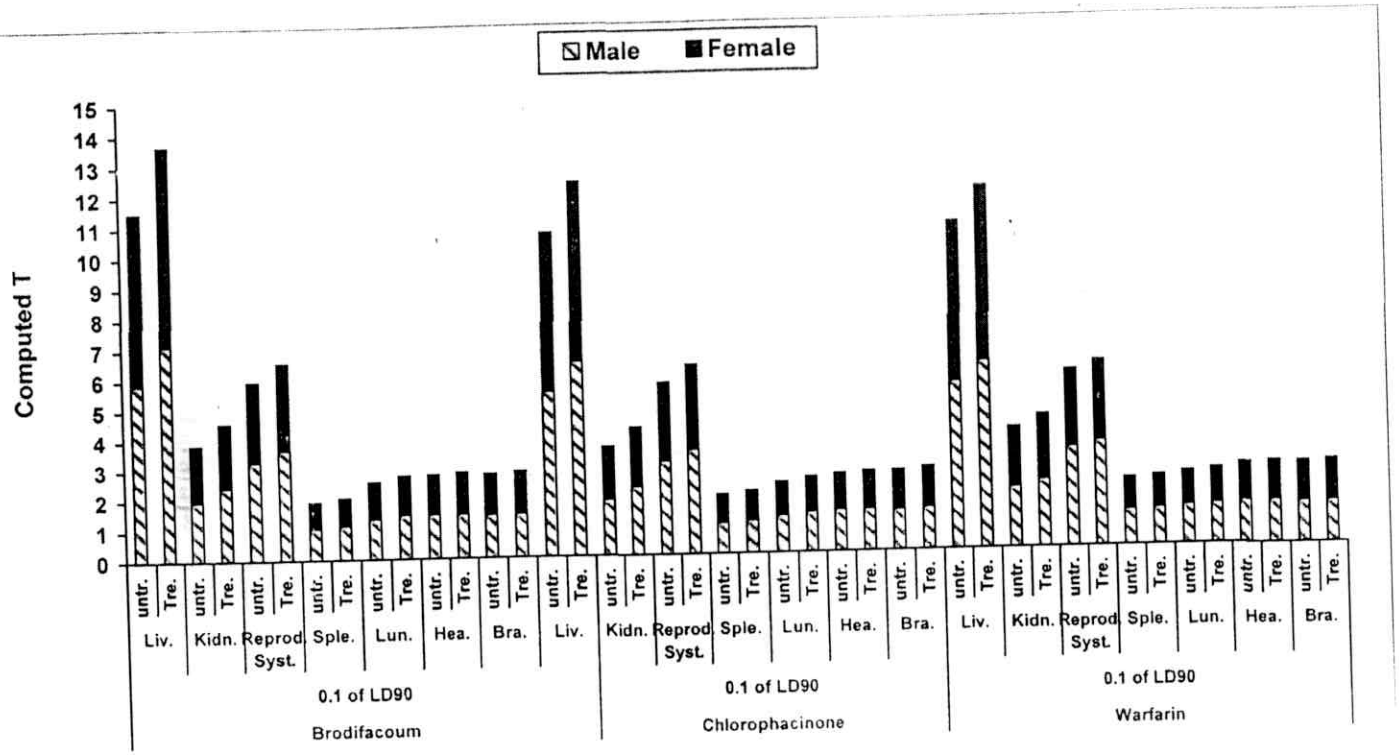


Fig (23): oral toxicity of different doses of 0.1 LD_{90} from Brodifacoum, Chlorophacinoe and Warfarin on various organs of both sexes of albino Norway rat *R. norvegicus* , which were fedon maize and wheat.

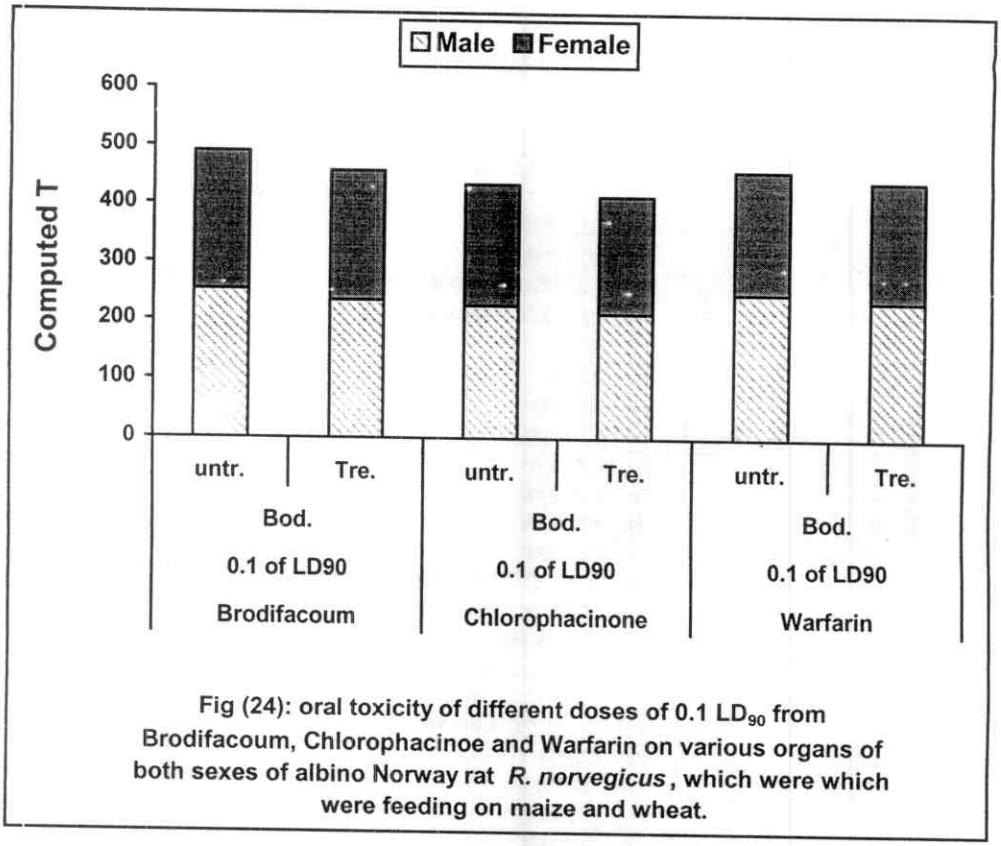


Fig (24): oral toxicity of different doses of 0.1 LD_{90} from Brodifacoum, Chlorophacinoe and Warfarin on various organs of both sexes of albino Norway rat *R. norvegicus*, which were which were feeding on maize and wheat.

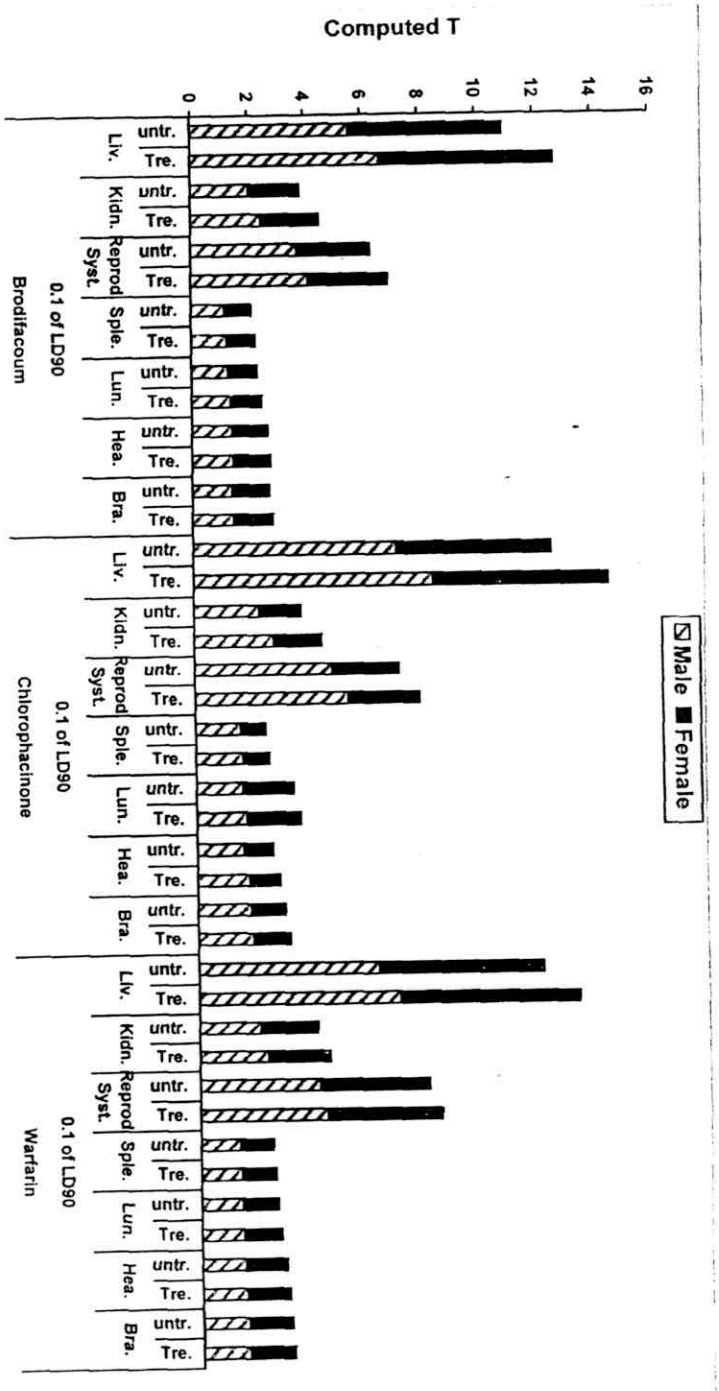


Fig (25): oral toxicity of different of 0.1 LD_{90} from Brodifacoum, Chlorophacinone and *Warfarin* on various organs of both sexes albino Norway rat *R. norvegicus*, which were feeding on vegetables.

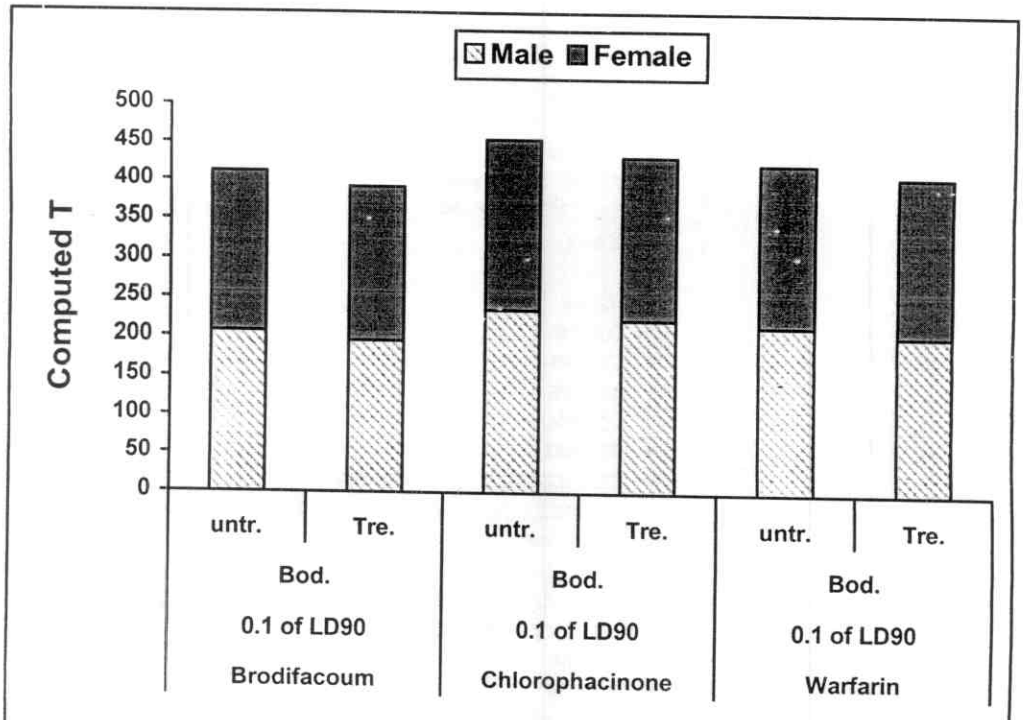


Fig (26): oral toxicity of different doses of 0.1 LD_{90} from Brodifacoum, Chlorophacinone and Warfarin on various organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on vegetables.

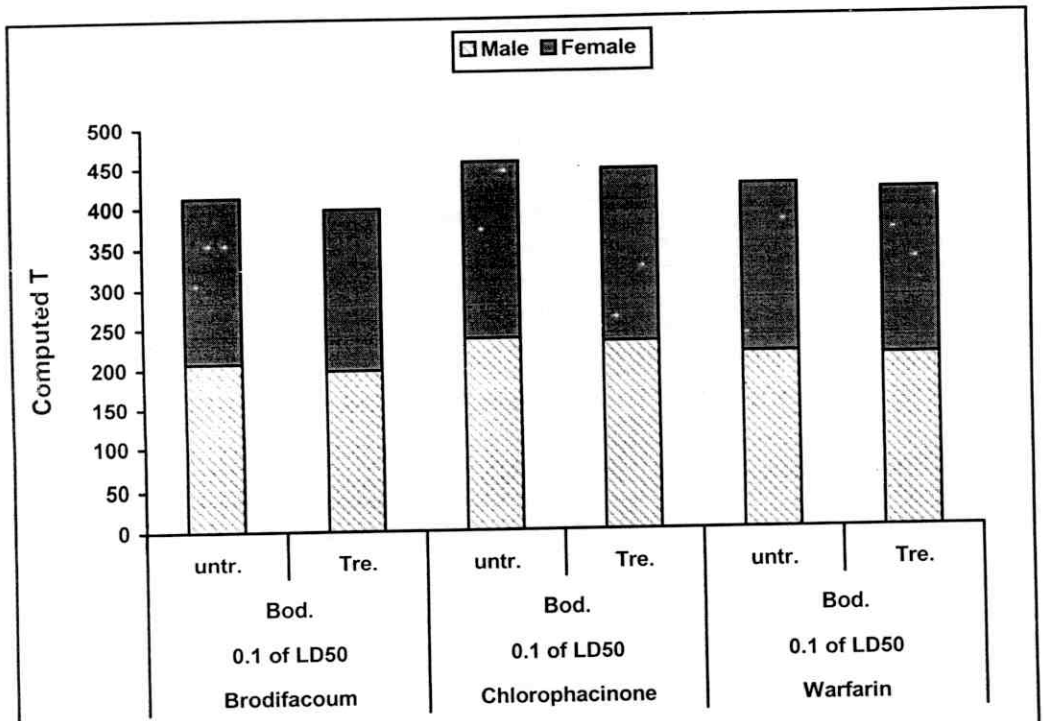


Fig (27): oral toxicity of different doses of 0.1 LD_{50} from Brodifacoum, Chlorophacinone and Warfarin on various organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on vegetables.

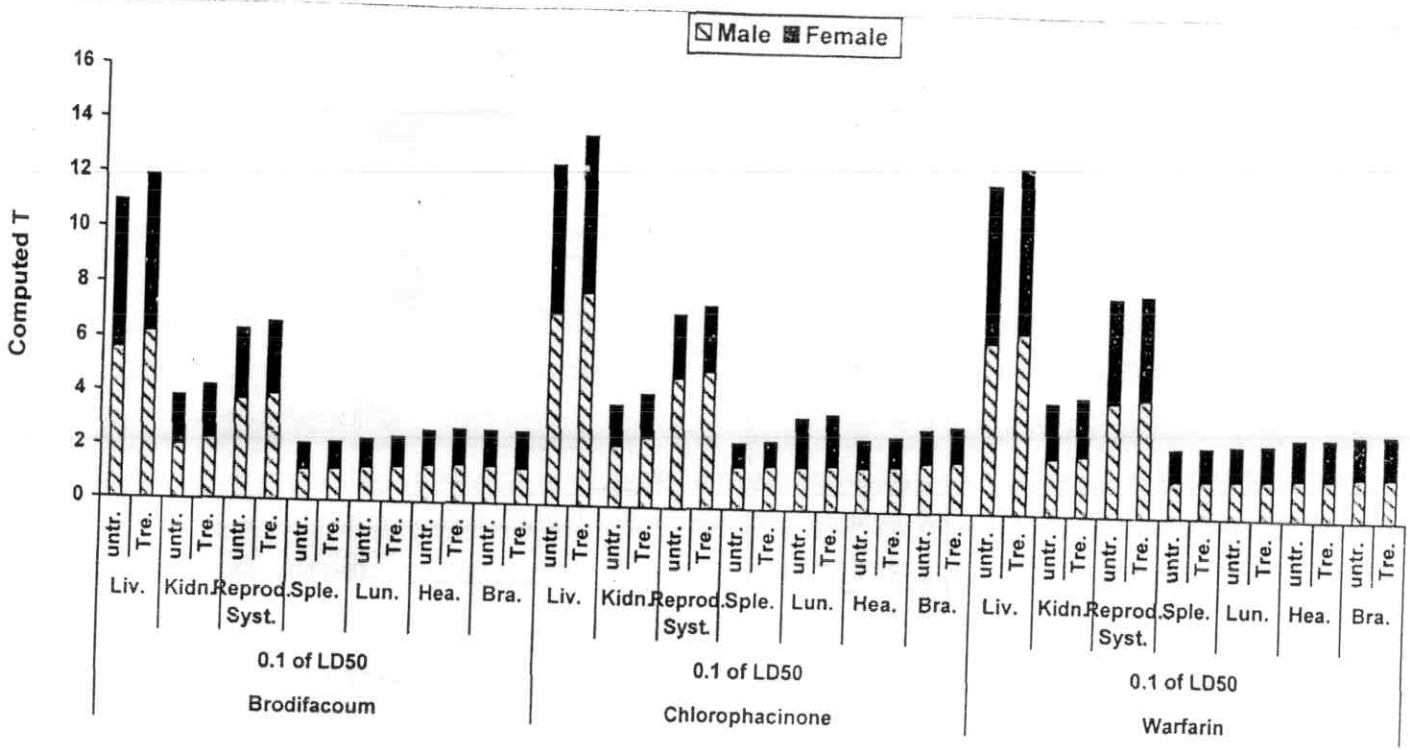


Fig (28): oral toxicity of different doses of 0.1 LD_{50} from Brodifacoum, Chlorophacinone and Warfarin on various organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on vegetables.

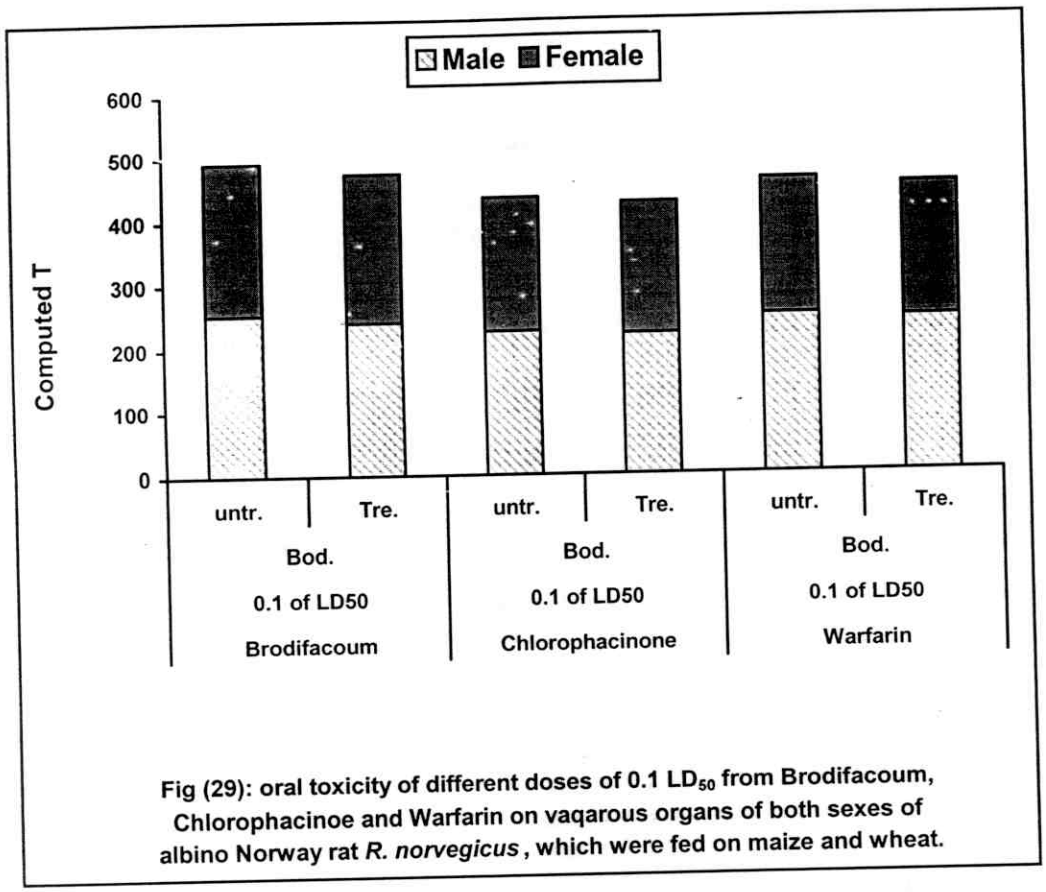


Fig (29): oral toxicity of different doses of 0.1 LD_{50} from Brodifacoum, Chlorophacinoe and Warfarin on vaqarous organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on maize and wheat.

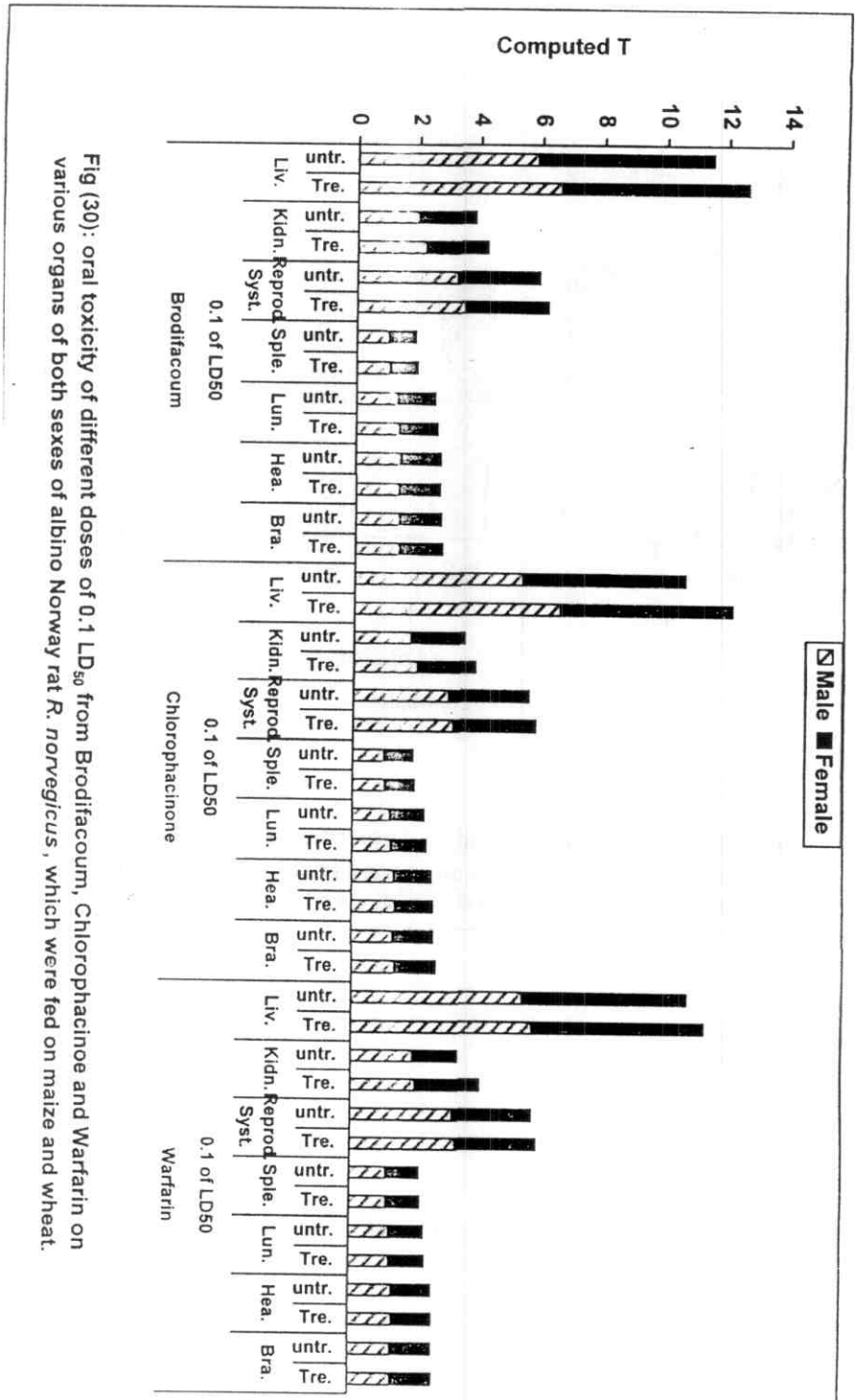


Fig (30): oral toxicity of different doses of 0.1 LD_{50} from Brodifacoum, Chlorophacinoe and Warfarin on various organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on maize and wheat.

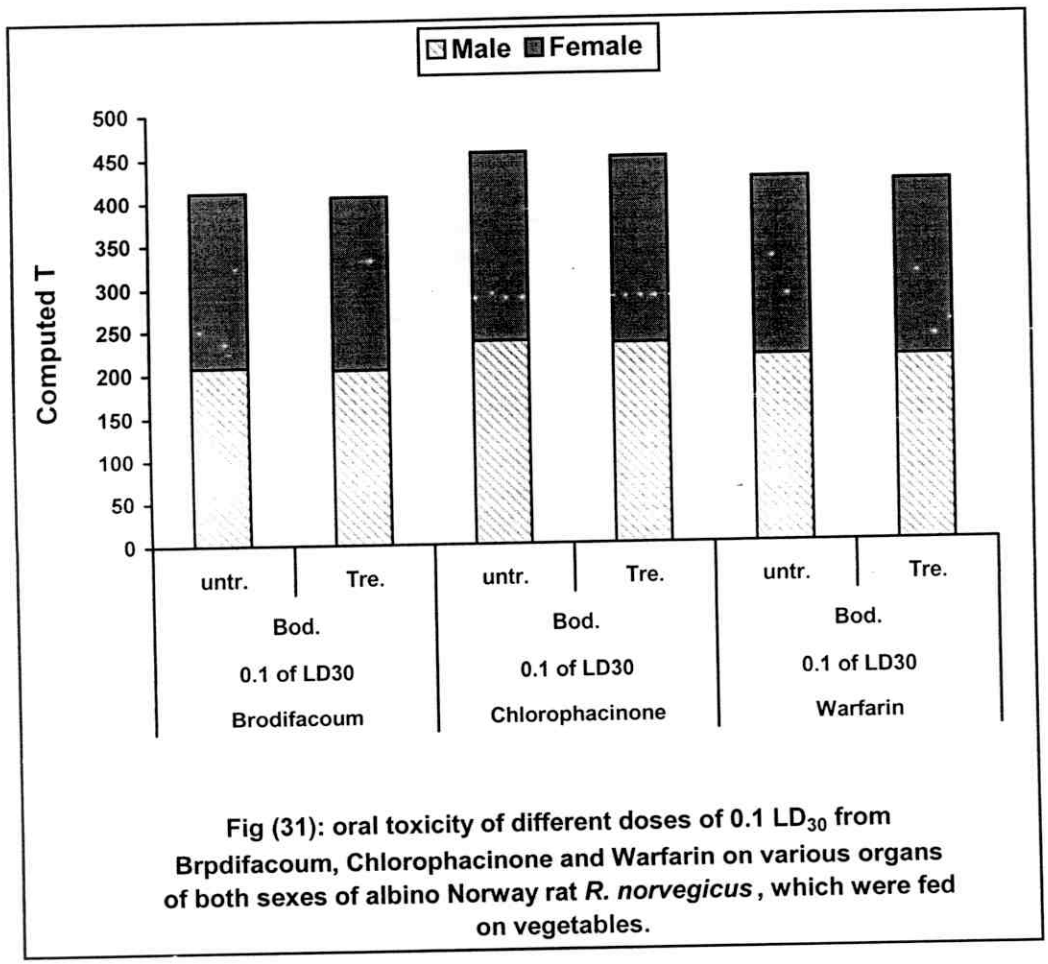


Fig (31): oral toxicity of different doses of 0.1 LD_{30} from Brpdifacoum, Chlorophacinone and Warfarin on various organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on vegetables.

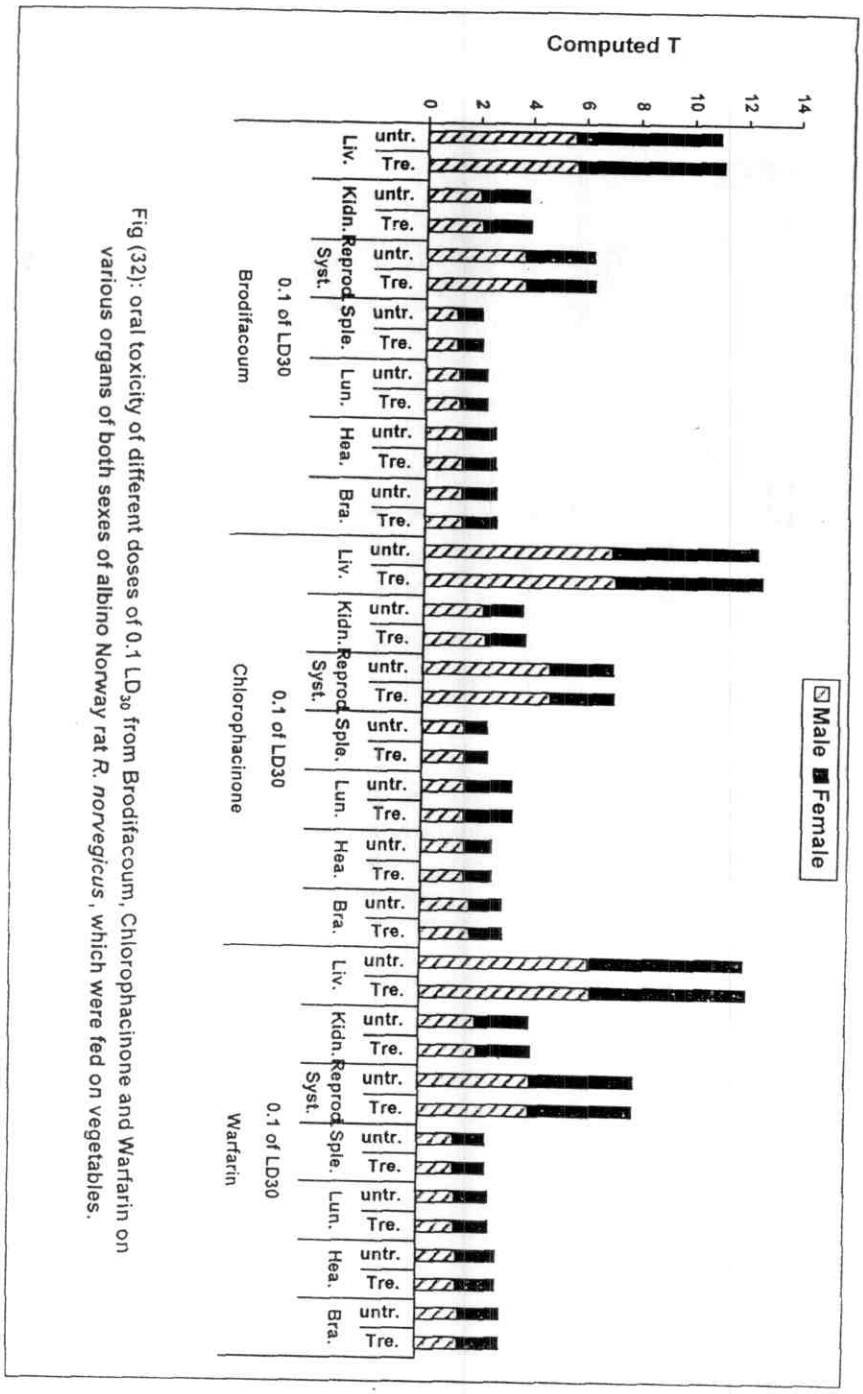


Fig (32): oral toxicity of different doses of 0.1 LD_{30} from Brodifacoum, Chlorophacinone and Warfarin on various organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on vegetables.

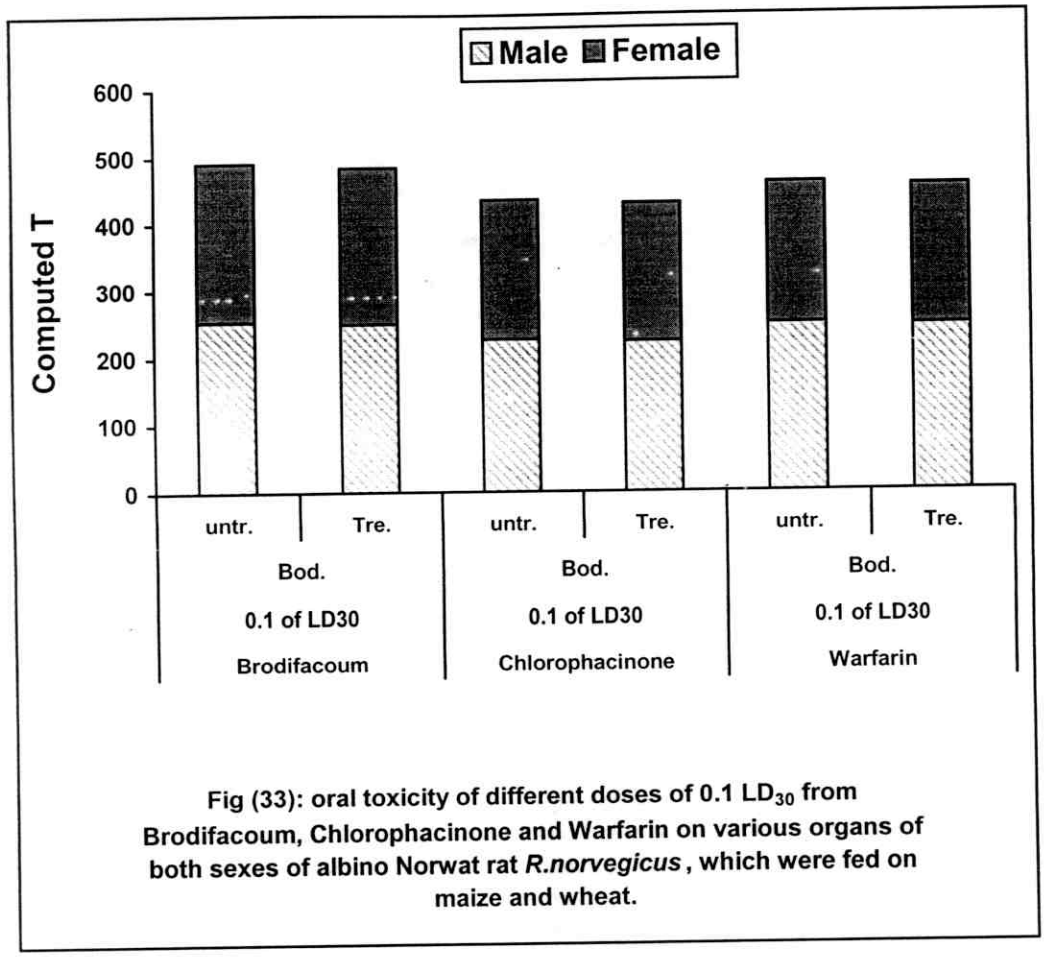


Fig (33): oral toxicity of different doses of 0.1 LD_{30} from Brodifacoum, Chlorophacinone and Warfarin on various organs of both sexes of albino Norwat rat *R.norvegicus*, which were fed on maize and wheat.

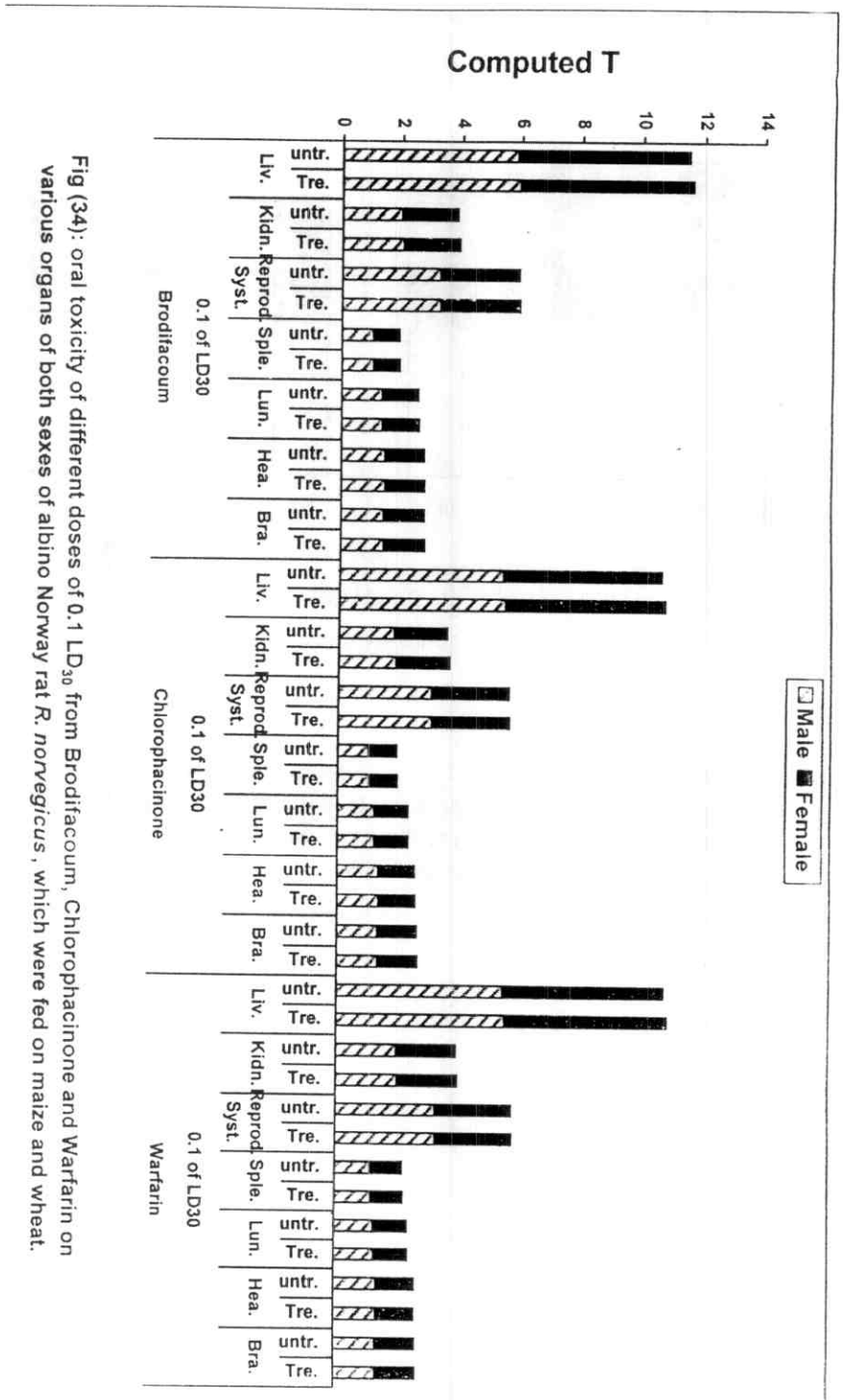
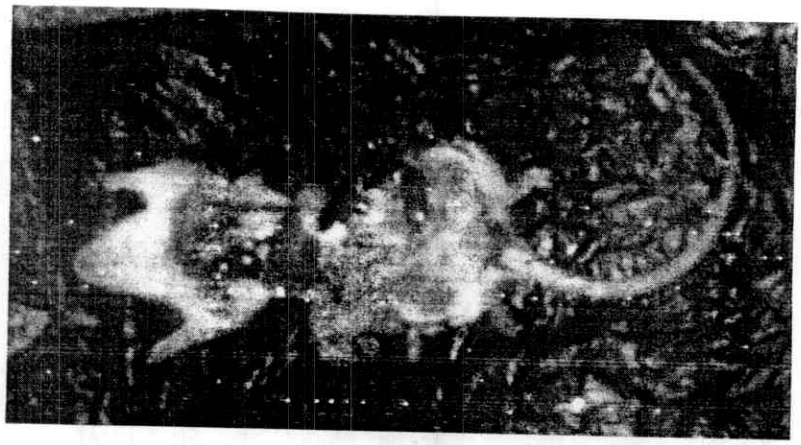


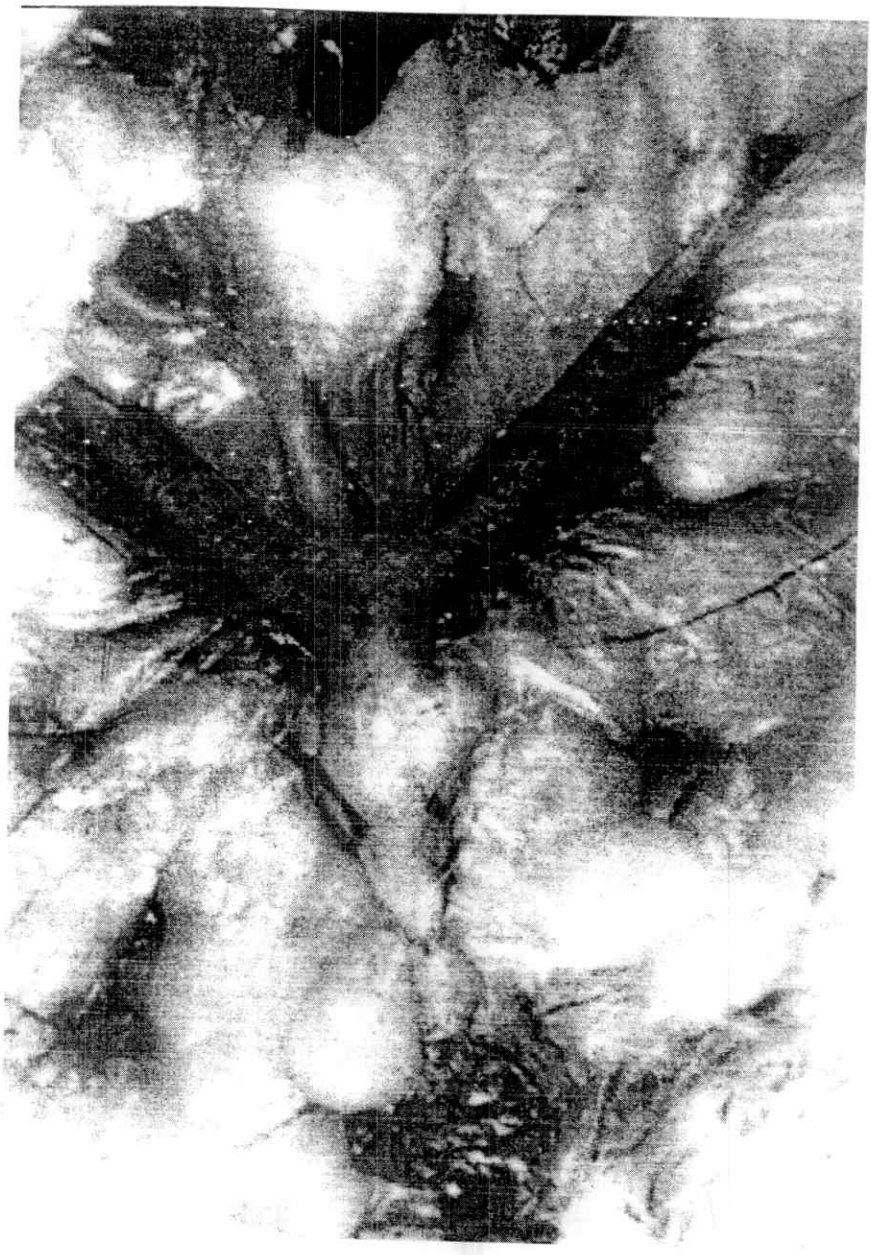
Fig (34): oral toxicity of different doses of 0.1 LD_{30} from Brodifacoum, Chlorophacinone and Warfarin on various organs of both sexes of albino Norway rat *R. norvegicus*, which were fed on maize and wheat.

Bleeding in uterus of non-pregnant female rat at the end of the 2nd week of 1/10 LD_{90} of Brodifacoum which was fed on vegetables for 2 weeks before and after treatments in presence of untreated male rat.



Uterus of pregnant female rat at the end of the 2nd week of gestation treated with 1/10 LD_{50} of Brodifacoum which was fed on vegetables for two weeks before and after treatment.

Clinical symptoms of female rat at the end of the 2nd week of gestation treated with 1/10 LD_{90} of Brodifacoum which was fed on vegetables for two weeks before and after treatment.



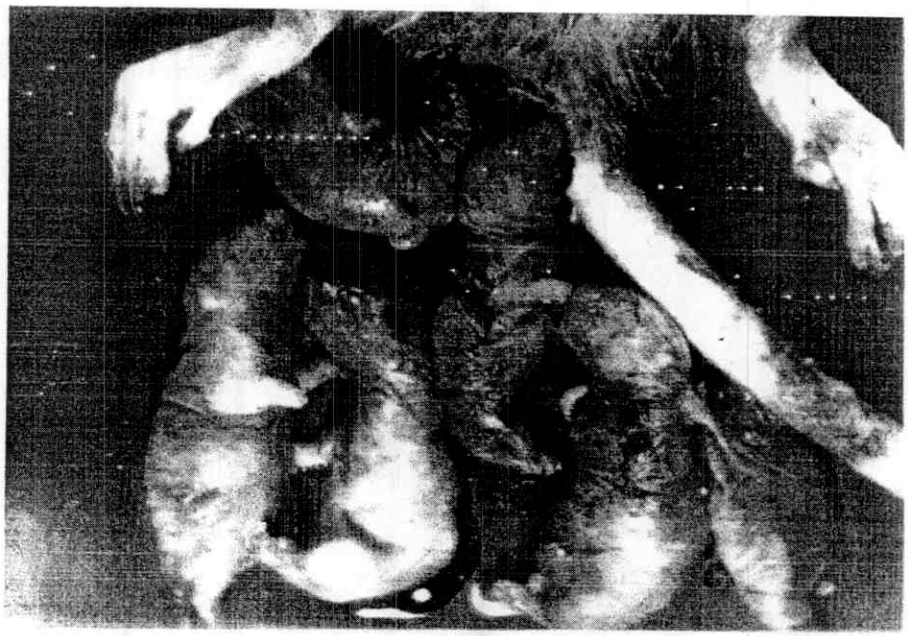
Uterus of non-pregnant female rat at the end of the 2nd week of gestation treated with 1/10 LD_{90} of Brodifacoum which was fed on maize and wheat for two weeks before and after treatment.

Uterus of pregnant female rat at the end of the 2nd week of gestation treated with 1/10 LD_{50} of Brodifacoum which was fed on maize and wheat for two weeks before and after treatment.

(A)

(B)

(C)

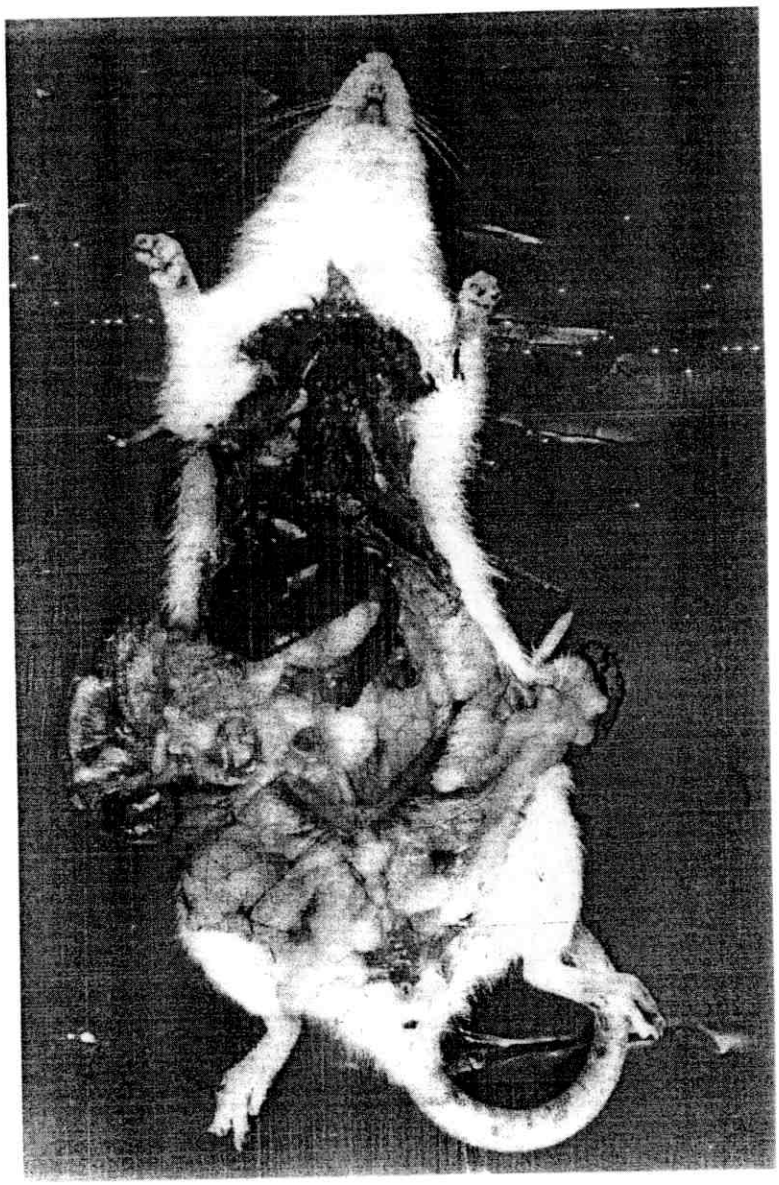


(A) Teratogenic effects.

(B) Enlarged uterus.

(C) Deformation fetuses.

Clinical symptoms resultant from normal female which was led on vegetables for two weeks before and after treatment with 0.01 LD30 of Brodifacoum which was mated from untreated male rat after directly treatment.



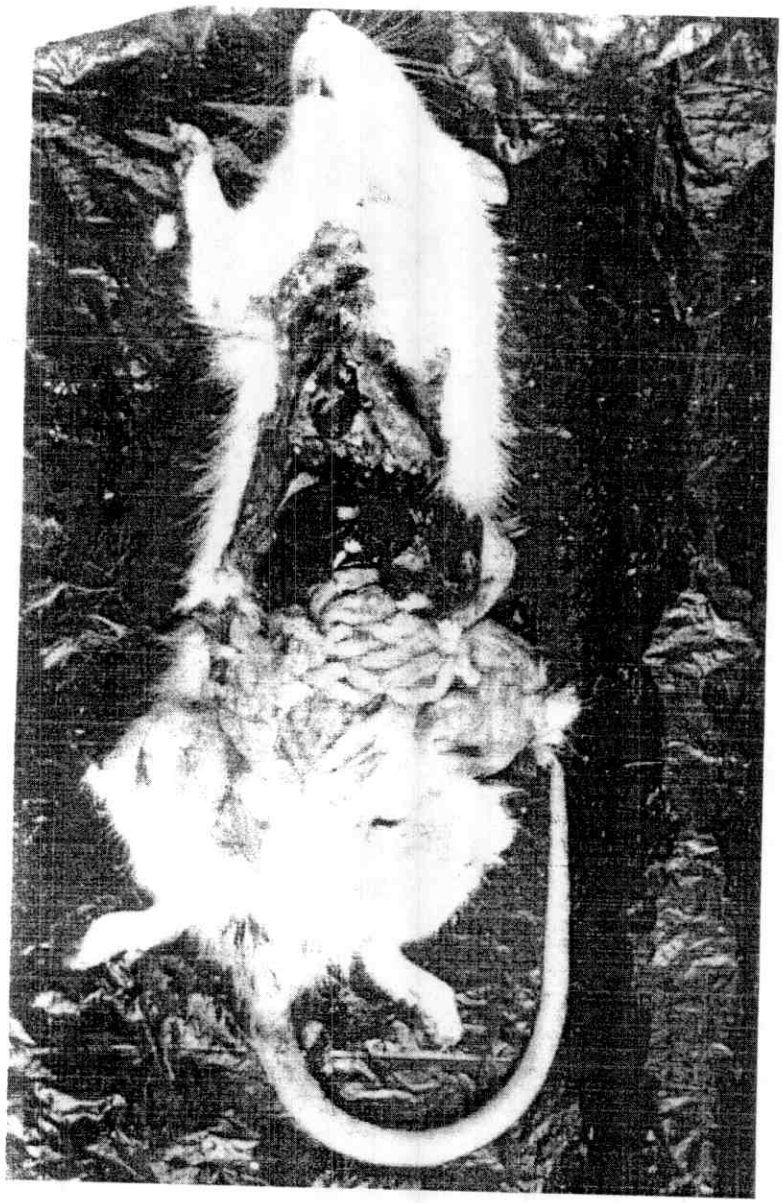
Bleeding in uterus of non-pregnant female rat at the end of the 2nd week of 1/10 LD_{90} of Chlorophacinone which was fed on vegetables for 2 weeks before and after treatments in presence of untreated male rat.

Uterus of pregnant female rat at the end of the 2nd week of gestation treated with 1/10 LD_{50} of Chlorophacinone which was fed on vegetables for two weeks before and after treatment.

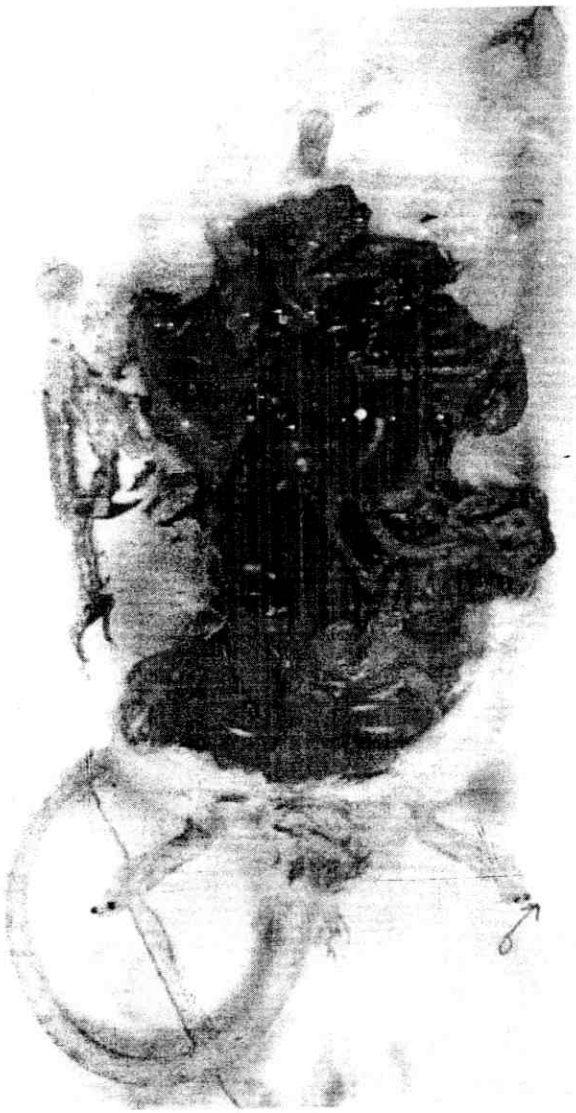
Clinical symptoms of female rat at the end of the 2nd week of gestation treated with 1/10 LD_{90} of Chlorophacinone which was fed on maize and wheat for 2 weeks before and after treatments.

Clinical symptoms of non-pregnant female rat at the end of the 2nd week of 1/10 LD_{90} of Chlorophacinone which was fed on maize and wheat for 2 weeks before and after treatments in presence of untreated male rat.

Clinical symptoms of female rat at the end of the 2nd week of gestation treated with 1/10 LD_{90} of Chlorophacinone which was fed on maize and wheat for two weeks before and after treatment.

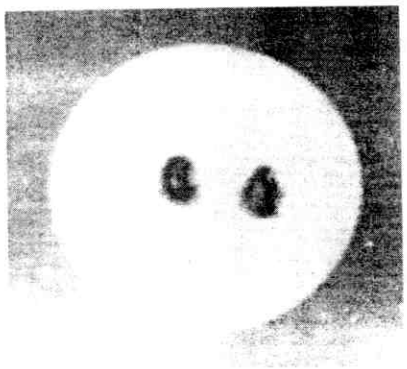


Uterus of pregnant female rat at the end of the 2nd week of gestation treated with 1/10 LD_{50} of Warfarin which was fed on vegetables for two weeks before and after treatment.

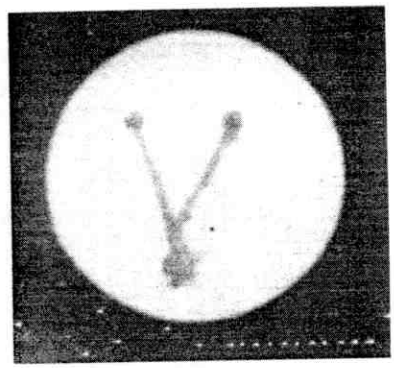


Clinical symptoms male rat at the end of the 2^{nt} week of gestation treated with 1/10 LD_{90}, of Warfarin which was fed on vegetables for two weeks before and after treatment.

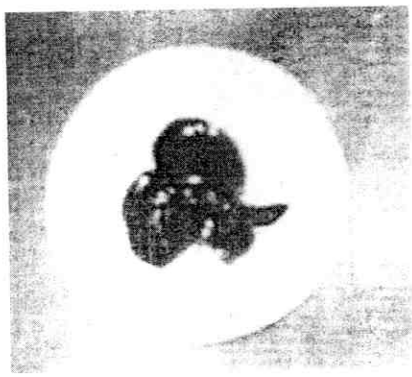
Clinical symptoms male rat at the end of the 2nd week of gestation treated with 1/10 LD50 of Warfarin which was fed on vegetables for two weeks before and after treatment.



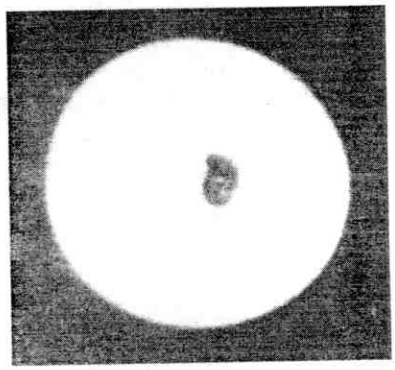
Kidney



Reproductive system

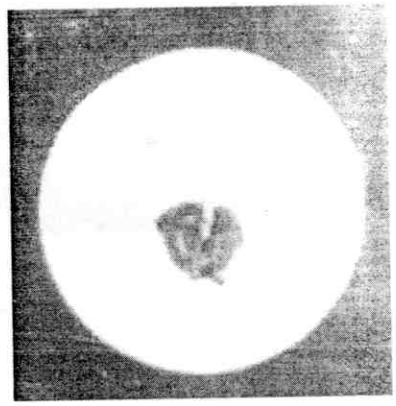


Liver



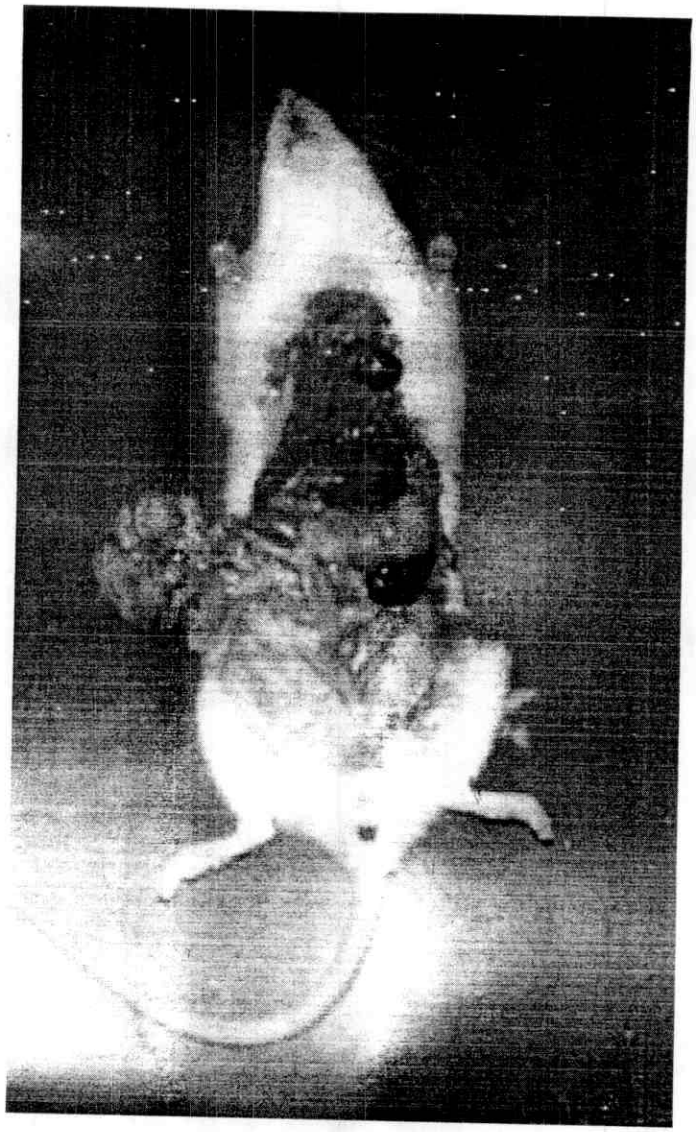
Heart

Spleen



Lung

The internal organs of untreated female rat.



Untreated female rat.