RESULTS AND DISCUSSION

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1. Effect of different treatments on normal rats :

Data in Table (2) and Fig. (1) revealed the effect of LP, FN, ML and NK as well as their mixture (at equal ratio) on blood hemoglobin. It is clearly shown from this Table that Hb was not affected by any of the used treatments during the experimental period (16 wks).

After 16 wks of treatment; LP, FN and ML did not caused any significant effect on blood sugar of normal rats while the low doses of NK and MIX (2.7 gm/kg b.w) caused a significant decrease in blood glucose level by 14.6% and 15.5%, respectivily (Table 3).

From Tables 4,5 and 6 and Fig's 3, 4 and 5 which reveals the effect of different treatments on liver function, it is clearly shown that LP, FN and ML at the two doses had no any significant effect on liver enzymes (ALT, AST, ALP) after 16 wks of treatment. NK did not affect ALT activity while increased AST activity by 20.6% after 16 wks of treatment and also, ALP activity was decreased by 18.2%. ALP activity was decreased by 24.2% after 16 wks of treatment in group of animals received the mixture at a dose of 2.7 g/kg b.w.

The effect of different treatments on serum proteins are presented in Tables 7-10 and Fig's 6-9.All treatments did not affecte serum total protein levels except for ML at he low dose which decreased the level

of total protein by 6.98% after 16 wks of treatment. The doubled dose of LP and FN caused a significant decrease in serum albumin levels after 16 wks of treatment. Serum globulin was only decreased by 17.1% in rats received the low dose of ML. Serum proteins of animals who received the MIX was not affected during the 16 wks of treatment.

The effect of all treatments on kidney function is present in Table 11-13 and Fig's 10-12. Blood urea levels were fluctuating during the 16 wks of treatment. However, the decrease or increase in urea levels, were still in the normal range and does not considered a pathological values. Serum creatinine levels were not affected due to the different treatments for 16 wks. Also, all treatments did not affect the level of serum uric acid during the course of the experiment.

Table 14 and Fig. 13 illustrate the effect of the different treatments on serum inorganic phosphorus. After 16 wks, no significant effect was observed in all groups of animals.

Both doses of LP increased s.total calcium after 16 wks of treatment by 19.4% and 18.8% respectivily . Also, the high dose of NK caused a significant increase in calcium level by 20.4%. The other treatments did not caused any effect on serum total calcium. Moreover, s.ionized calcium (Table 16 and Fig. 15) was not affected by any treatment during the experimental period.

FN and ML caused a slight decreases in s.sodium level after 16 wks of treatments (Table 17 and Fig. 16).

Serum potassium levels (Table 18 and Fig. 17) were not affected by the different treatments during the course of experiment.

ML and MIX caused significant increases in serum total cholesterol after 16 wks of treatments (Table 19 and Fig. 18). On the other hand serum triglycerides (Table 20 and Fig. 19) were not affected by the different treatments during the course of experiment.

In general, it was clearly shown from the previous data that the different treatments did not show any dramatic effect on normal rats but some fluctuations in the data were recorded during the 16 wks of treatment. The fluctuations remained in the normal range of the relative parameters in most cases.

Blood glucose was significantly reduced in the groups of the animals which received NK and MIX. This means that NK was more effective on blood glucose level than LP, FN or ML.

After 16 weeks of treatment, LP caused a signifcant decrease in serum albumin. FN caused a remarkable decrease in serum albumin and sodium. ML caused a significant decrease in serum total proteins, globulins and sodium content. NK caused a significant increase in serum ALT. This means that any one from the previous plants upon usage for a long period of time could cause undesirable effect. The use of the mixture which containing these plants in equal parts caused the same hypoglycemic effect with a menimal undesirable effect. The pharmacological activity of these plants will be discuss in more details in the third part.

Table (2) : Percent variations and statistical significance of differences induced by the effect of different treatments on Hemoglobin of albino rats .

Gr. No.	Types of treatment	Mean values (gm / dl ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	15.3 ± 1.11	15.0 ± 0.58 t (- 1.96 %)	15.9 ± 1.13 t (+ 3.92 %)	15.8 ± 0.65 t (+ 3.26 %)
2	LP (2.7 gm/kg b.w)	15.3 ± 1.29	14.9 ± 1.07 t (- 2.61 %)	14.9 ± 1.44 t (- 2.61 %)	14.7 ± 1.49 t (- 3.92 %)
3	LP (5.4 gm/kg b.w)	15.1 ± 1.15	14.8 ± 0.81 t (- 1.98 %)	14.3 ± 1.54 t (- 5.29 %)	14.6 ± 2.36 t (- 3.31 %)
4	FN (2.7 gm/kg b.w)	15.4 ± 0.74	15.1 ± 0.76 t (- 1.94 %)	16.1 ± 0.54 t (+ 4.54 %)	15.4 ± 0.57 t (`0.00 %)
5	FN (5.4 gm/kg b.w)	15.2 ± 1.28	14.4 ± 1.23 t (- 5.26 %)	14.8 ± 1.89 t (- 2.63 %)	14.9 ± 1.03 t (- 1.97 %)
6	ML (2.7 gm/kg b.w)	15.7 ± 0.64	14.8 ± 1.09 t (- 5.73 %)	14.9 ± 1.89 t (- 5.09 %)	15.1 ± 0.65 t (- 3.82 %)
7	ML (5.4 gm/kg b.w)	15.3 ± 1.07	14.7 ± 0.62 t (- 3.92 %)	14.3 ± 0.63 t (- 6.53 %)	14.9 ± 1.65 t (- 2.61 %)
8	NK (2.7 gm/kg b.w)	15.7 ± 2.44	13.7 ± 0.88 t (- 12.73 %)	13.5 ± 1.23 t (- 14.0 %)	13.9 ± 1.45 t (- 11.4 %)
9	NK (5.4 gm/kg b.w)	15.7 ± 1.95	15.7 ± 1.08 t (`0.00 %)	15.7 ± 1.25 t (`0.00 %)	14.6 ± 0.69 t (- 7.00 %)
10	MIX (2.7 gm/kg b.w)	15.0 ± 0.76	15.2 ± 1.13 t (+ 1.33 %)	15.7 ± 0.93 t (+ 4.66 %)	15.3 ± 1.19 t (+ 2.00 %)
11	MIX (5.4 gm/kg b.w)	15.0 ± 1.50	14.8 ± 0.92 t (- 1.33 %)	15.0 ± 2.19 t (`0.00 %)	14.8 ± 1.74 t (- 1.33 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

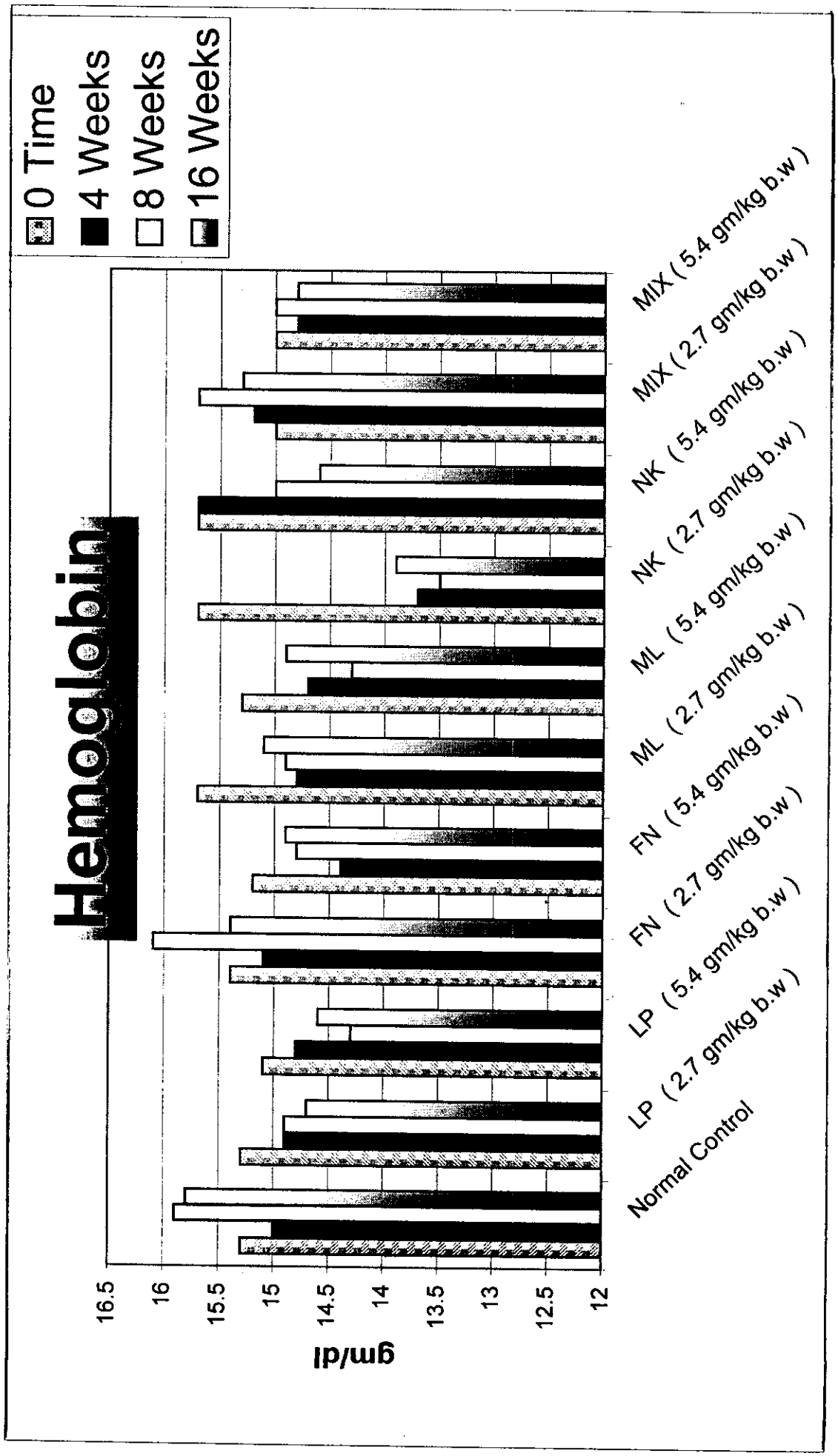

Fig (1) : Hemoglobin levels (gm/dl) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (3) : Percent variations and statistical significance of differences induced by the effect of different treatments on Blood Glucose of albino rats .

Gr. No.	Types of treatment	Mean values (mg / dl ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	99.9 ± 3.01	100.7 ± 5.74 t (+ 0.80 %)	102.6 ± 5.95 t (+ 2.70 %)	102.3 ± 11.4 t (+ 2.40 %)
2	LP (2.7 gm/kg b.w)	101.8 ± 4.74	102.9 ± 7.08 t (+ 1.08 %)	95.4 ± 12.9 t (- 6.29 %)	99.0 ± 9.01 t (- 2.75 %)
3	LP (5.4 gm/kg b.w)	100.3 ± 6.12	105.0 ± 10.8 t (+ 4.69 %)	106.3 ± 8.20 t (+ 5.98 %)	100.9 ± 14.9 t (+ 0.60 %)
4	FN (2.7 gm/kg b.w)	102.1 ± 2.86	100.5 ± 2.90 t (- 1.57 %)	96.6 ± 9.16 t (- 5.39 %)	112.5 ± 10.4 t (+ 10.2 %)
5	FN (5.4 gm/kg b.w)	101.6 ± 5.17	98.0 ± 6.27 t (- 3.54 %)	93.7 ± 14.5 t (- 7.77 %)	102.4 ± 9.84 t (+ 0.79 %)
6	ML (2.7 gm/kg b.w)	100.7 ± 5.85	94.6 ± 11.3 t (- 6.06 %)	88.9 ± 10.6 * (- 11.7 %)	94.5 ± 8.61 t (- 6.16 %)
7	ML (5.4 gm/kg b.w)	100.9 ± 6.28	94.5 ± 10.8 t (- 6.34 %)	89.8 ± 7.69 * (- 11.0 %)	105.5 ± 9.85 t (+ 4.56 %)
8	NK (2.7 gm/kg b.w)	101.1 ± 6.15	98.4 ± 7.87 t (- 2.67 %)	88.6 ± 9.98 * (- 12.4 %)	86.3 ± 12.8 * (- 14.6 %)
9	NK (5.4 gm/kg b.w)	100.2 ± 5.93	104.8 ± 8.17 t (+ 4.59 %)	101.6 ± 17.2 t (+ 1.40 %)	95.5 ± 15.9 t (- 4.69 %)
10	MIX (2.7 gm/kg b.w)	104.3 ± 6.87	99.9 ± 10.2 t (- 4.22 %)	96.4 ± 8.65 t (- 7.57 %)	88.1 ± 6.19 ** (- 15.5 %)
11	MIX (5.4 gm/kg b.w)	103.0 ± 6.06	96.4 ± 9.82 t (- 6.41 %)	93.4 ± 10.8 * (- 9.32 %)	90.5 ± 6.04 ** (- 12.1 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

** : Highly Signficant difference from the corresponding control at $p < 0.001$

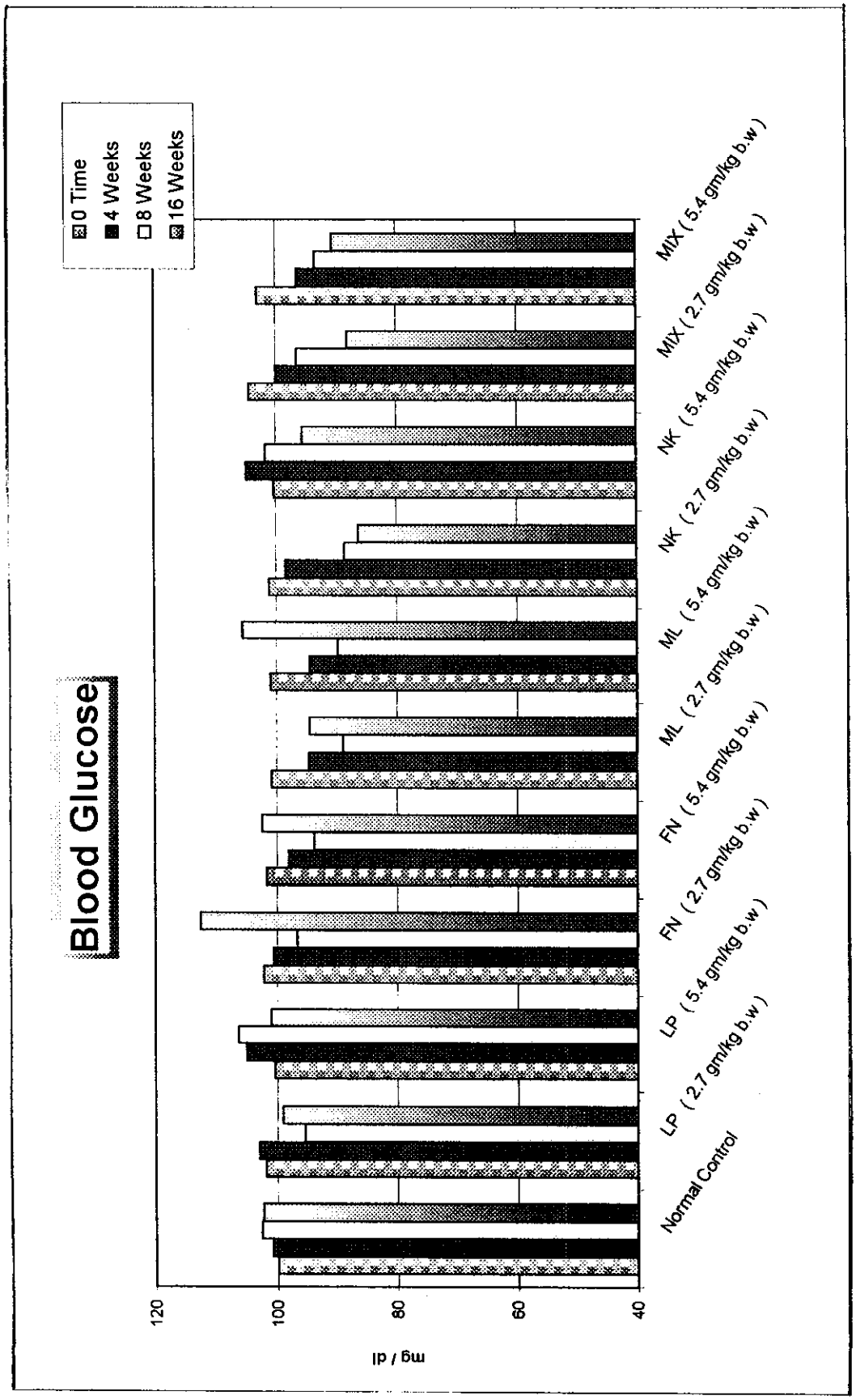

Fig (2): Blood Glucose Levels (mg/dl) of different treated animal groups during 16 weeks of treatment compared to 0 time

Table (4) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum ALT of albino rats .

Gr. No.	Types of treatment	Mean values (U/L ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	45.4 ± 5.41	47.6 ± 7.73 t (+ 4.85 %)	45.8 ± 11.4 t (+ 0.88 %)	46.2 ± 9.93 t (+ 1.76 %)
2	LP (2.7gm/kg b.w)	42.1 ± 6.12	42.7 ± 6.53 t (+ 1.43 %)	40.8 ± 10.2 t (- 3.09 %)	36.8 ± 9.19 t (- 12.60 %)
3	LP (5.4 gm/kg b.w)	48.2 ± 4.12	44.8 ± 5.15 t (- 7.05 %)	38.3 ± 7.31 ** (- 20.5 %)	46.7 ± 9.56 t (- 3.11 %)
4	FN (2.7 gm/kg b.w)	44.1 ± 5.11	51.3 ± 6.56 t (+ 16.3 %)	41.8 ± 10.1 t (- 5.22 %)	45.2 ± 6.34 t (+ 2.49 %)
5	FN (5.4 gm/kg b.w)	43.2 ± 5.01	43.0 ± 13.1 t (- 0.46 %)	36.8 ± 8.61 t (- 14.8 %)	46.2 ± 6.11 t (+ 6.94 %)
6	ML (2.7 gm/kg b.w)	47.7 ± 4.12	53.7 ± 9.99 t (+ 12.6 %)	54.6 ± 13.3 t (+ 14.5 %)	42.2 ± 4.72 t (- 11.5 %)
7	ML (5.4 gm/kg b.w)	41.8 ± 2.11	49.2 ± 11.2 t (+ 17.7 %)	42.7 ± 8.59 t (+ 2.15 %)	40.8 ± 3.66 t (- 2.39 %)
8	NK (2.7 gm/kg b.w)	45.6 ± 5.12	54.3 ± 13.1 t (+ 19.1 %)	46.7 ± 8.85 t (+ 2.41 %)	47.3 ± 4.46 t (+ 3.73 %)
9	NK (5.4 gm/kg b.w)	47.2 ± 3.08	55.7 ± 10.5 t (+ 18.0 %)	44.2 ± 9.28 t (- 6.35 %)	47.7 ± 7.74 t (+ 1.06 %)
10	MIX (2.7 gm/kg b.w)	44.4 ± 4.09	37.2 ± 4.75 t (- 16.2 %)	38.5 ± 4.42 t (- 13.3 %)	49.0 ± 6.36 t (+ 10.4 %)
11	MIX (5.4 gm/kg b.w)	46.2 ± 4.12	48.5 ± 12.9 t (+ 4.98 %)	40.0 ± 4.52 * (- 13.4 %)	47.1 ± 6.37 t (+ 1.95 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

** : Highly Signficant difference from the corresponding control at $p < 0.001$

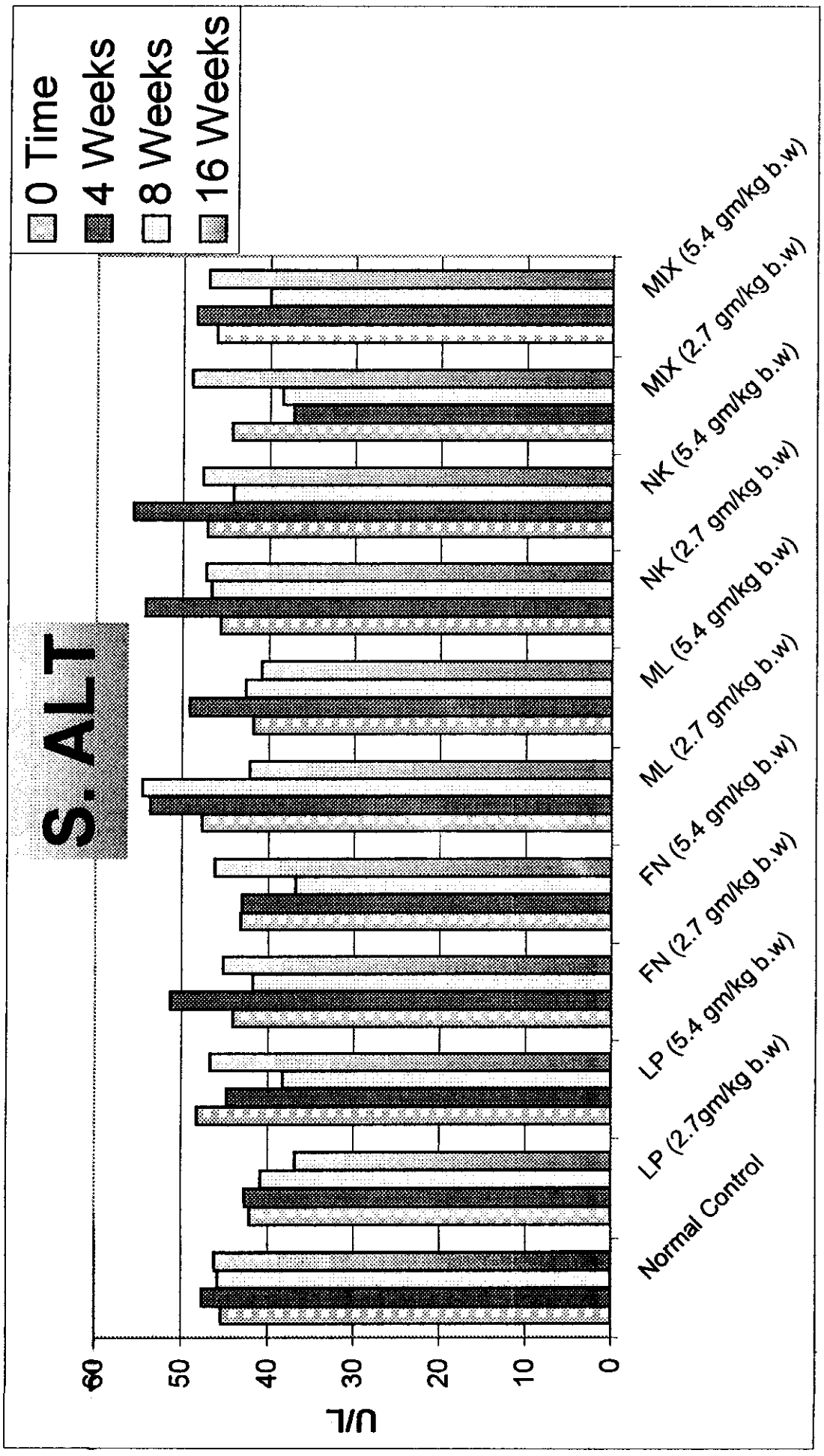

Fig (3) : ALT levels (U/L) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (5) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum AST of albino rats .

Gr. No.	Types of treatment	Mean values (U/L ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	78.7 ± 9.12	78.6 ± 12.0 t (- 0.13 %)	88.2 ± 22.0 t (+ 12.1 %)	83.5 ± 17.2 t (+ 6.10 %)
2	LP (2.7gm/kg b.w)	79.4 ± 6.14	79.3 ± 17.4 t (- 0.13 %)	83.5 ± 20.6 t (+ 5.16 %)	94.0 ± 18.6 t (+ 18.4 %)
3	LP (5.4 gm/kg b.w)	74.4 ± 5.21	78.5 ± 9.31 t (+ 5.51 %)	71.3 ± 7.97 t (- 4.17 %)	79.7 ± 11.3 t (+ 7.12 %)
4	FN (2.7 gm/kg b.w)	69.8 ± 7.21	70.8 ± 4.26 t (+ 1.43 %)	83.5 ± 14.3 t (+ 19.6 %)	79.8 ± 11.2 t (+ 14.3 %)
5	FN (5.4 gm/kg b.w)	77.7 ± 6.81	91.6 ± 22.1 t (+ 17.9 %)	87.4 ± 17.1 t (+ 12.5 %)	72.2 ± 11.3 t (- 7.08 %)
6	ML (2.7 gm/kg b.w)	72.1 ± 6.01	76.7 ± 12.8 t (+ 6.38 %)	86.2 ± 12.0 * (+ 19.6 %)	74.0 ± 10.6 t (+ 2.63 %)
7	ML (5.4 gm/kg b.w)	75.1 ± 6.82	86.3 ± 20.1 t (+ 14.9 %)	81.5 ± 6.12 t (+ 8.52 %)	71.3 ± 14.6 t (- 5.06 %)
8	NK (2.7 gm/kg b.w)	72.4 ± 5.94	92.3 ± 22.1 t (+ 27.5 %)	94.2 ± 23.1 * (+ 30.1 %)	87.3 ± 12.3 * (+ 20.6 %)
9	NK (5.4 gm/kg b.w)	78.2 ± 5.81	90.2 ± 5.71 ** (+ 15.3 %)	120.1 ± 18.9 *** (+ 53.6 %)	84.3 ± 10.5 * (+ 7.80 %)
10	MIX (2.7 gm/kg b.w)	72.4 ± 6.02	81.5 ± 15.3 t (+ 12.6 %)	89.2 ± 22.1 t (+ 23.2 %)	76.0 ± 15.5 t (+ 4.97 %)
11	MIX (5.4 gm/kg b.w)	77.7 ± 6.82	95.3 ± 19.6 * (+ 22.6 %)	85.3 ± 9.52 t (+ 9.78 %)	80.6 ± 10.5 t (+ 3.73 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

** : Highly signficant difference from the corresponding control at $p < 0.001$

*** : Very highly sighficant difference from the corresponding control at $p > 0.01$

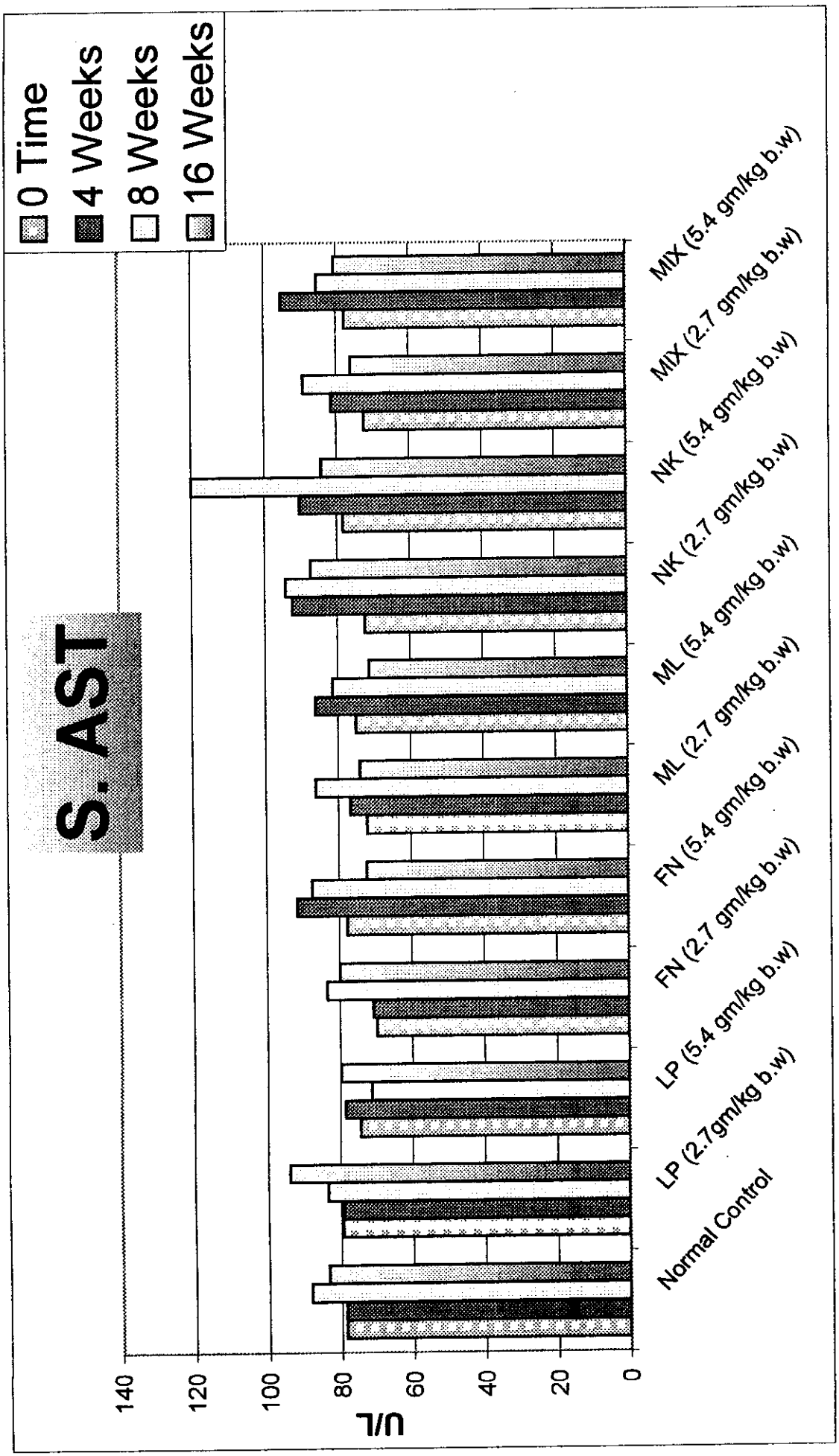

Fig (4) : AST levels (U/L) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (6) : Percent variations and statistical significance of differences indced by the effect of different treatments on Serum ALP of albino rats .

Gr. No.	Types of treatment	Mean values (U/L ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	235.0 ± 37.1	223.0 ± 10.8 t (- 5.11 %)	238.2 ± 53.9 t (+ 1.36 %)	236.1 ± 30.1 t (+ 0.43 %)
2	LP (2.7gm/kg b.w)	227.5 ± 48.6	208.8 ± 26.9 t (- 8.22 %)	240.8 ± 35.1 t (+ 5.85 %)	234.8 ± 58.7 t (+ 3.21 %)
3	LP (5.4 gm/kg b.w)	185.7 ± 14.5	161.2 ± 18.8 * (- 13.2 %)	166.6 ± 32.1 t (- 10.3 %)	173.0 ± 10.1 t (- 6.84 %)
4	FN (2.7 gm/kg b.w)	181.2 ± 29.3	166.0 ± 17.4 t (- 8.39 %)	155.2 ± 32.4 t (- 14.3 %)	160.7 ± 32.0 t (- 11.3 %)
5	FN (5.4 gm/kg b.w)	214.2 ± 45.9	203.4 ± 21.9 t (- 5.04 %)	182.0 ± 18.6 t (- 15.0 %)	184.7 ± 46.2 t (- 13.8 %)
6	ML (2.7 gm/kg b.w)	208.2 ± 40.2	196.4 ± 17.5 t (- 5.67 %)	195.5 ± 46.2 t (- 6.10 %)	195.7 ± 48.9 t (- 6.00 %)
7	ML (5.4 gm/kg b.w)	185.8 ± 35.6	189.0 ± 19.1 t (+ 1.72 %)	195.5 ± 43.1 t (+ 5.22 %)	206.0 ± 33.5 t (+ 10.9 %)
8	NK (2.7 gm/kg b.w)	231.7 ± 25.4	205.2 ± 22.2 t (- 11.4 %)	186.5 ± 34.6 t (- 19.5 %)	189.5 ± 31.4 * (- 18.2 %)
9	NK (5.4 gm/kg b.w)	240.3 ± 52.2	207.0 ± 10.5 t (- 13.8 %)	190.7 ± 34.6 t (- 20.6 %)	213.5 ± 38.5 t (- 11.2 %)
10	MIX (2.7 gm/kg b.w)	241.8 ± 36.7	223.2 ± 23.3 t (- 7.69 %)	185.4 ± 39.5 * (- 23.3 %)	183.3 ± 45.8 * (- 24.2 %)
11	MIX (5.4 gm/kg b.w)	238.7 ± 17.7	205.0 ± 29.2 * (- 14.1 %)	191.4 ± 24.1 ** (- 19.8 %)	208.7 ± 48.2 t (- 12.6 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

** : Highly Signficant difference from the corresponding control at $p < 0.001$

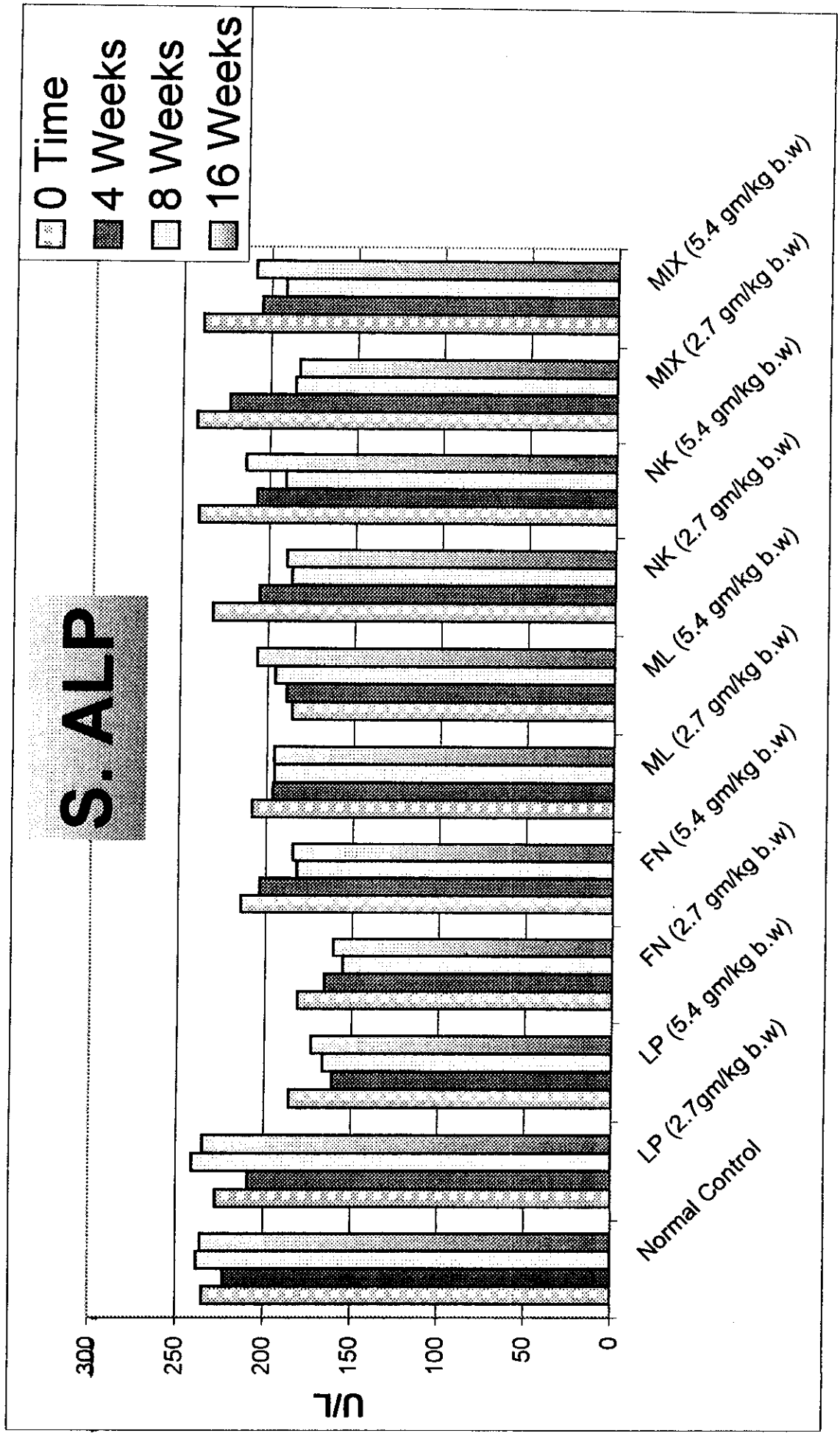

Fig (5) : ALP levels (U/L) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (7) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum Total Protein of albino rats .

Gr. No.	Types of treatment	Mean values (gm/dl ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	8.4 ± 0.88	8.1 ± 0.62 t (- 3.57 %)	8.3 ± 0.25 t (- 1.19 %)	8.1 ± 0.82 t (- 3.57 %)
2	LP (2.7gm/kg b.w)	8.4 ± 0.55	7.8 ± 0.29 * (- 7.14 %)	8.2 ± 0.88 t (- 2.38 %)	8.4 ± 0.70 t (`0.00 %)
3	LP (5.4 gm/kg b.w)	8.5 ± 0.76	8.6 ± 0.49 t (+ 1.18 %)	8.1 ± 0.61 t (- 4.71 %)	8.0 ± 0.21 t (- 5.88 %)
4	FN (2.7 gm/kg b.w)	8.1 ± 0.50	8.2 ± 0.51 t (+ 1.23 %)	8.0 ± 0.32 t (- 1.23 %)	8.1 ± 0.42 t (`0.00 %)
5	FN (5.4 gm/kg b.w)	8.8 ± 0.93	8.4 ± 0.57 t (- 4.54 %)	8.3 ± 0.60 t (- 5.68 %)	8.2 ± 0.31 t (- 6.82 %)
6	ML (2.7 gm/kg b.w)	8.6 ± 0.41	8.5 ± 0.49 t (- 1.16 %)	8.1 ± 0.61 t (- 5.81 %)	8.0 ± 0.42 * (- 6.98 %)
7	ML (5.4 gm/kg b.w)	8.6 ± 0.78	8.3 ± 0.53 t (- 3.49 %)	7.9 ± 0.43 t (- 8.14 %)	7.9 ± 0.98 t (- 8.14 %)
8	NK (2.7 gm/kg b.w)	8.3 ± 0.99	8.1 ± 0.26 t (- 2.41 %)	8.3 ± 0.58 t (`0.00 %)	8.2 ± 0.47 t (- 1.20 %)
9	NK (5.4 gm/kg b.w)	8.5 ± 0.76	8.4 ± 0.55 t (- 1.18 %)	7.8 ± 0.38 t (- 8.23 %)	8.0 ± 0.66 t (- 5.88 %)
10	MIX (2.7 gm/kg b.w)	8.4 ± 0.80	8.4 ± 0.42 t (`0.00 %)	8.2 ± 0.26 t (- 2.38 %)	8.2 ± 0.71 t (- 2.38 %)
11	MIX (5.4 gm/kg b.w)	8.0 ± 0.57	8.3 ± 0.80 t (+ 3.75 %)	8.1 ± 0.58 t (+ 1.25 %)	8.0 ± 0.46 t (`0.00 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

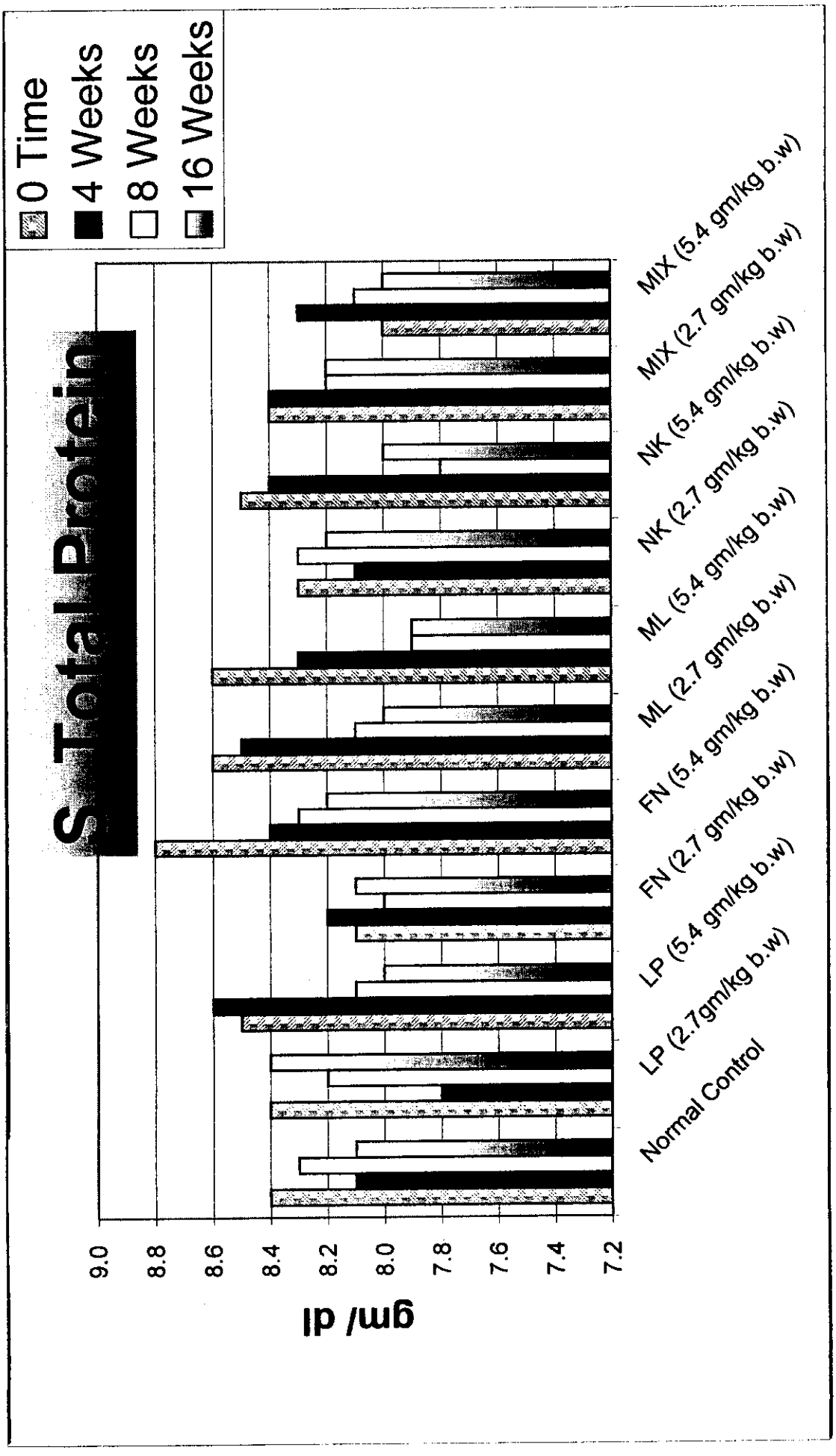

Fig (6) : Total Protein levels (gm/dl) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (8) : Percent variations and statistical significance of differences induced by the effect of different tratments on Serum Albumin of albino rats.

Gr. No.	Types of treatment	Mean values (gm/dl ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	4.3 ± 0.18	4.6 ± 0.90 t (+ 6.98 %)	4.1 ± 0.30 t (- 4.65 %)	4.3 ± 0.26 t (`0.00 %)
2	LP (2.7gm/kg b.w)	4.8 ± 0.53	4.1 ± 0.23 * (- 14.6 %)	4.5 ± 0.19 t (- 6.25 %)	4.6 ± 0.54 t (- 4.17 %)
3	LP (5.4 gm/kg b.w)	5.2 ± 0.28	4.5 ± 0.89 t (- 13.5 %)	4.5 ± 0.52 * (- 13.5 %)	4.5 ± 0.44 ** (- 13.5 %)
4	FN (2.7 gm/kg b.w)	4.7 ± 0.27	4.4 ± 0.87 t (- 6.38 %)	4.2 ± 0.44 * (- 10.6 %)	4.4 ± 0.47 t (- 6.38 %)
5	FN (5.4 gm/kg b.w)	4.9 ± 0.39	4.4 ± 0.81 t (- 0.20 %)	4.2 ± 0.21 * (- 14.3 %)	4.4 ± 0.30 * (- 10.2 %)
6	ML (2.7 gm/kg b.w)	4.5 ± 0.39	4.5 ± 0.64 t (`0.00 %)	4.3 ± 0.23 t (- 4.44 %)	4.6 ± 0.57 t (+ 2.22 %)
7	ML (5.4 gm/kg b.w)	4.7 ± 0.08	4.6 ± 0.30 t (- 2.13 %)	4.6 ± 0.35 t (- 2.13 %)	4.5 ± 0.39 t (- 4.26 %)
8	NK (2.7 gm/kg b.w)	4.4 ± 0.16	4.0 ± 0.22 * (- 9.09 %)	4.7 ± 0.42 t (+ 6.82 %)	4.5 ± 0.46 t (+ 2.27 %)
9	NK (5.4 gm/kg b.w)	4.4 ± 0.12	4.4 ± 0.81 t (`0.00 %)	4.3 ± 0.43 t (- 2.27 %)	4.6 ± 0.29 t (+ 4.55 %)
10	MIX (2.7 gm/kg b.w)	4.6 ± 0.17	4.3 ± 0.29 t (- 6.52 %)	4.7 ± 0.27 t (+ 2.17 %)	4.9 ± 0.31 t (+ 6.52 %)
11	MIX (5.4 gm/kg b.w)	4.5 ± 0.05	4.2 ± 0.30 t (- 6.67 %)	4.5 ± 0.38 t (`0.00 %)	4.5 ± 0.44 t (`0.00 %)

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** : Highly Signficant difference from the corresponding control at $p < 0.001$

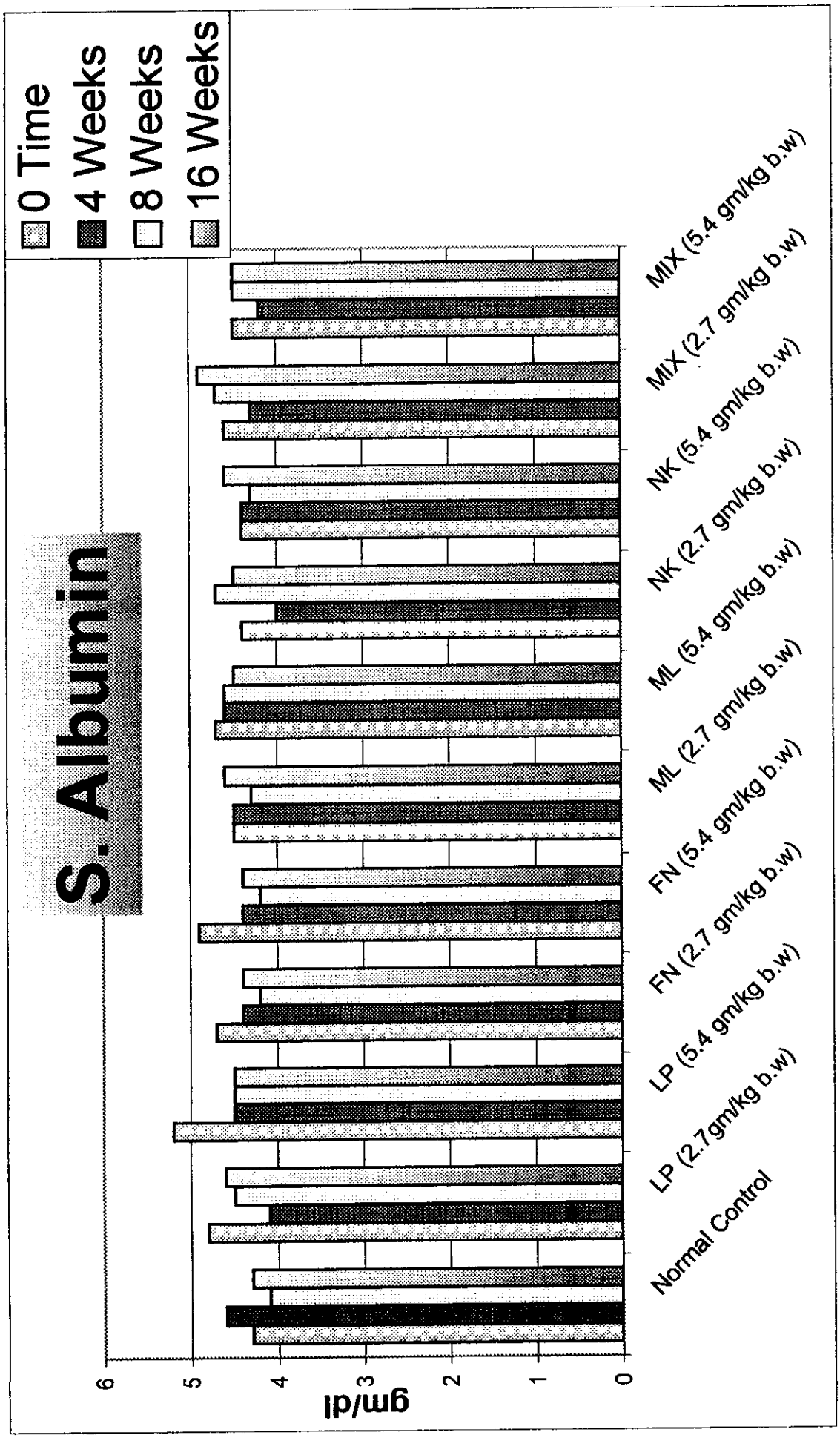


Fig (7) : Albumin levels (gm / dl) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (9) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum Globulin albino rats.

Gr. No.	Types of treatment	Mean values (gm/dl ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	4.1 ± 0.77	3.5 ± 0.76 t (- 14.6 %)	4.2 ± 0.42 t (+ 2.44 %)	3.8 ± 0.62 t (- 7.3.2 %)
2	LP (2.7gm/kg b.w)	3.6 ± 0.64	3.7 ± 0.19 t (+ 2.78 %)	3.7 ± 0.63 t (+2.78 %)	3.8 ± 0.42 t (+ 5.56 %)
3	LP (5.4 gm/kg b.w)	3.3 ± 0.81	4.1 ± 0.75 t (+ 24.2 %)	3.6 ± 0.60 t (+ 9.09 %)	3.5 ± 0.48 t (+ 6.06 %)
4	FN (2.7 gm/kg b.w)	3.4 ± 0.33	4.1 ± 0.79 t (+ 20.6 %)	3.8 ± 0.57 t (+ 11.8 %)	3.8 ± 0.54 t (+ 11.8 %)
5	FN (5.4 gm/kg b.w)	3.9 ± 0.89	4.0 ± 0.63 t (+ 2.56 %)	4.1 ± 0.44 t (+ 5.13 %)	3.8 ± 0.56 t (- 2.56 %)
6	ML (2.7 gm/kg b.w)	4.1 ± 0.58	4.0 ± 0.26 t (- 2.44 %)	3.8 ± 0.64 t (- 7.32 %)	3.4 ± 0.43 * (- 17.1 %)
7	ML (5.4 gm/kg b.w)	3.9 ± 0.78	3.7 ± 0.46 t (- 5.13 %)	3.3 ± 0.54 t (- 15.4 %)	3.4 ± 0.77 t (- 12.8 %)
8	NK (2.7 gm/kg b.w)	3.9 ± 0.77	4.1 ± 0.12 t (+ 5.13 %)	3.6 ± 0.68 t (- 7.69 %)	3.7 ± 0.48 t (- 5.13 %)
9	NK (5.4 gm/kg b.w)	4.1 ± 0.71	4.0 ± 0.51 t (- 2.44 %)	3.5 ± 0.60 t (- 14.6 %)	3.4 ± 0.37 t (- 17.1 %)
10	MIX (2.7 gm/kg b.w)	3.8 ± 0.90	4.1 ± 0.48 t (+ 7.89 %)	3.5 ± 0.38 t (- 7.89 %)	3.3 ± 0.42 t (- 13.2 %)
11	MIX (5.4 gm/kg b.w)	3.5 ± 0.56	4.1 ± 0.65 t (+ 17.1 %)	3.6 ± 0.34 t (+ 2.86 %)	3.5 ± 0.33 t (0.00 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

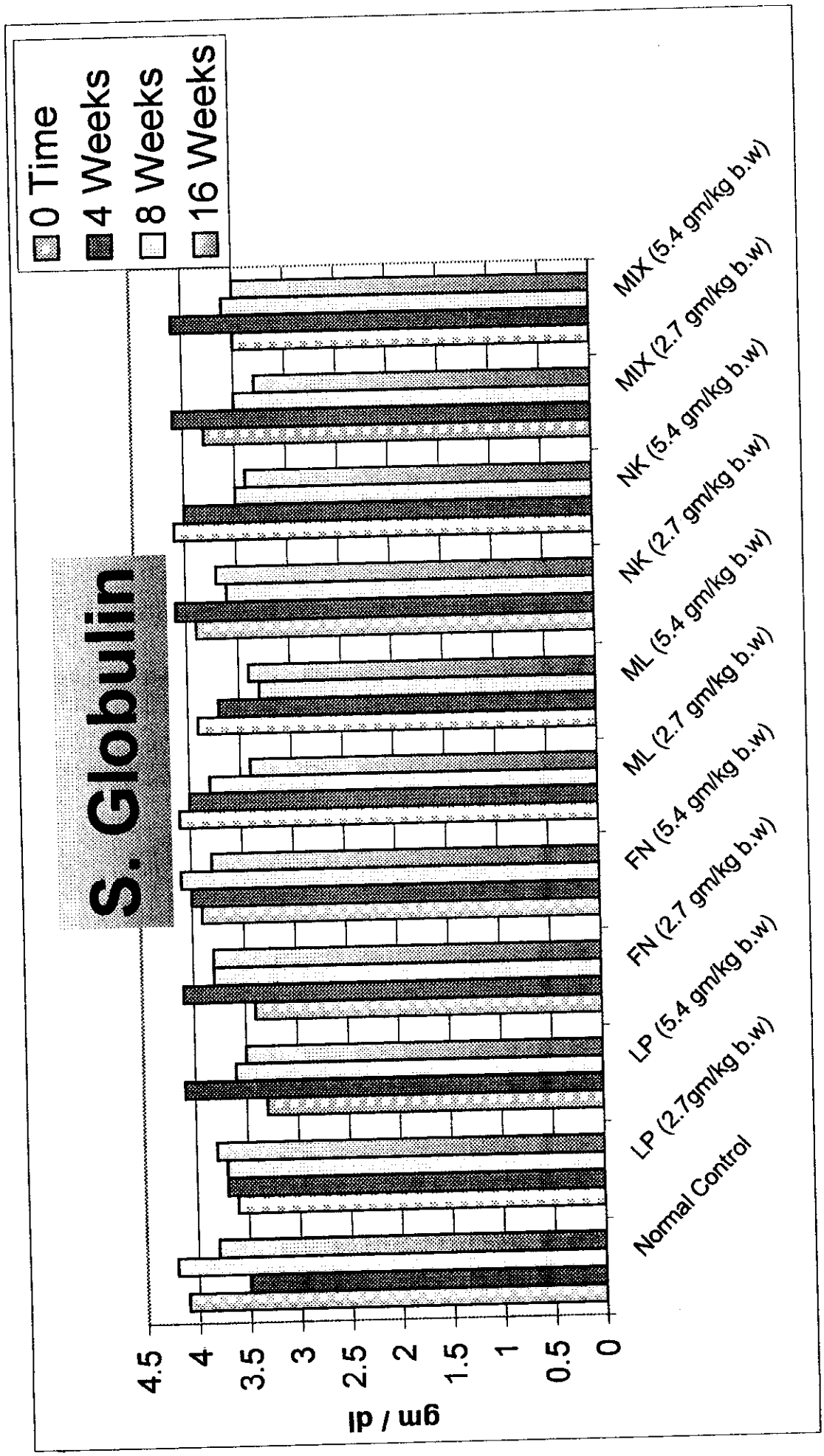


Fig (8) : Globulin levels (gm / dl) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (10) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum Albumin / Globulin of albino rats .

Gr. No.	Types of treatment	Mean values ± S.D and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	1.05 ± 0.18	1.31 ± 0.21 * (+ 24.8 %)	0.98 ± 0.16 t (- 6.67 %)	1.13 ± 0.24 t (+ 7.62 %)
2	LP (2.7gm/kg b.w)	1.33 ± 0.30	1.11 ± 0.27 t (- 16.5 %)	1.22 ± 0.23 t (- 8.27 %)	1.21 ± 0.20 t (- 9.02 %)
3	LP (5.4 gm/kg b.w)	1.58 ± 0.36	1.10 ± 0.27 * (- 30.4 %)	1.30 ± 0.21 t (- 17.7 %)	1.28 ± 0.27 t (- 19.0 %)
4	FN (2.7 gm/kg b.w)	1.38 ± 0.25	1.00 ± 0.24 * (- 27.5 %)	1.11 ± 0.25 t (- 19.6 %)	1.16 ± 0.29 t (- 15.9 %)
5	FN (5.4 gm/kg b.w)	1.26 ± 0.32	1.10 ± 0.27 t (- 19.6 %)	1.02 ± 0.08 t (- 19.0 %)	1.16 ± 0.24 t (- 7.94 %)
6	ML (2.7 gm/kg b.w)	1.10 ± 0.25	1.12 ± 0.21 t (+ 1.82 %)	1.13 ± 0.19 t (+ 2.73 %)	1.35 ± 0.31 t (+ 22.7 %)
7	ML (5.4 gm/kg b.w)	1.20 ± 0.22	1.24 ± 0.20 t (+ 3.33 %)	1.39 ± 0.30 t (+ 15.8 %)	1.32 ± 0.29 t (+ 10.0 %)
8	NK (2.7 gm/kg b.w)	1.13 ± 0.27	0.98 ± 0.06 t (- 13.3 %)	1.31 ± 0.33 t (+ 15.9 %)	1.22 ± 0.26 t (+ 7.96 %)
9	NK (5.4 gm/kg b.w)	1.07 ± 0.19	1.00 ± 0.18 t (- 6.54 %)	1.23 ± 0.34 t (+ 14.9 %)	1.35 ± 0.20 * (+ 26.2 %)
10	MIX (2.7 gm/kg b.w)	1.21 ± 0.29	1.05 ± 0.19 t (- 13.2 %)	1.34 ± 0.23 t (+ 10.7 %)	1.48 ± 0.22 t (+ 22.3 %)
11	MIX (5.4 gm/kg b.w)	1.28 ± 0.23	1.02 ± 0.16 t (- 20.3 %)	1.25 ± 0.13 t (- 2.34 %)	1.28 ± 0.22 t (`0.00 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

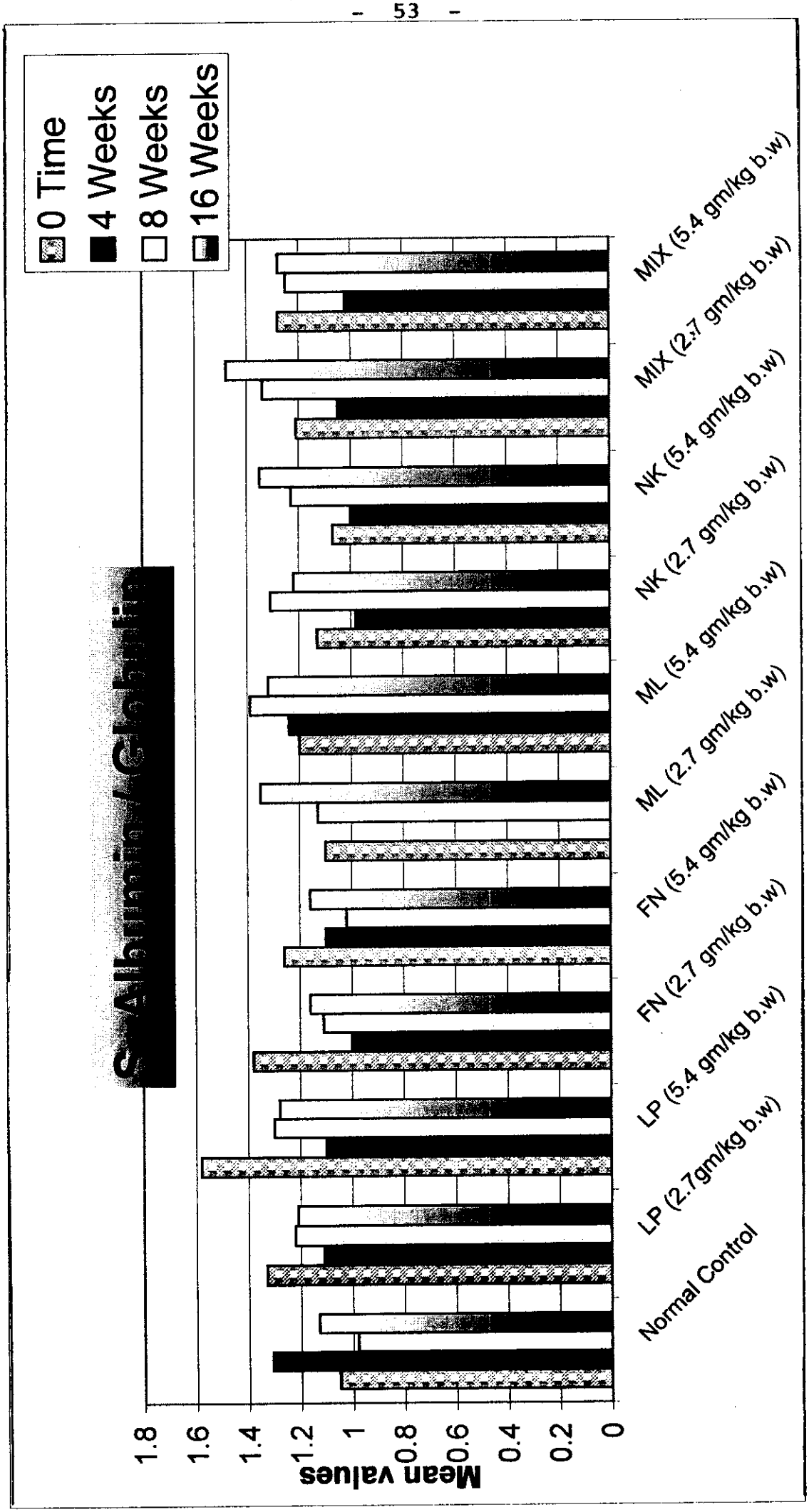


Fig (9): Albumin / Globulin levels of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (11) : Percent variations and statistical significance of differences induced by the effect of different treatments on Blood Urea of albino rats .

Gr. No.	Types of treatment	Mean values (mg/dl ± S.D) and% change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	27.2 ± 3.39	26.8 ± 3.37 t (- 1.47 %)	28.7 ± 1.20 t (+ 5.51 %)	30.2 ± 2.09 t (+ 11.0 %)
2	LP (2.7gm/kg b.w)	27.0 ± 2.27	31.3 ± 5.24 t (+ 15.9 %)	33.6 ± 7.23 t (+ 24.4 %)	36.9 ± 8.86 * (+ 36.7 %)
3	LP (5.4 gm/kg b.w)	24.2 ± 2.56	27.5 ± 5.01 t (+ 13.6 %)	25.1 ± 1.66 t (+ 3.72 %)	26.9 ± 5.19 t (+ 11.2 %)
4	FN (2.7 gm/kg b.w)	27.6 ± 2.29	28.8 ± 3.54 t (+ 4.35 %)	32.9 ± 4.94 * (+ 19.2 %)	31.7 ± 2.88 * (+ 14.8 %)
5	FN (5.4 gm/kg b.w)	26.9 ± 3.36	30.7 ± 3.39 t (+ 14.1 %)	30.9 ± 4.57 t (+ 14.8 %)	32.1 ± 3.07 * (+ 19.3 %)
6	ML (2.7 gm/kg b.w)	28.8 ± 3.48	30.0 ± 3.85 t (+ 4.17 %)	33.9 ± 3.46 * (+ 17.7 %)	34.8 ± 4.96 * (+ 20.8 %)
7	ML (5.4 gm/kg b.w)	27.6 ± 2.72	31.3 ± 2.42 * (+ 13.4 %)	32.6 ± 3.35 ** (+ 18.1 %)	35.5 ± 5.29 ** (+ 28.6 %)
8	NK (2.7 gm/kg b.w)	27.5 ± 4.74	32.8 ± 7.08 t (+ 19.3 %)	31.1 ± 2.72 t (+ 13.1 %)	28.6 ± 1.03 t (+ 4.00 %)
9	NK (5.4 gm/kg b.w)	26.5 ± 3.35	30.3 ± 2.66 t (+ 14.3 %)	31.2 ± 7.40 t (+ 17.7%)	28.8 ± 4.34 t (+ 8.68 %)
10	MIX (2.7 gm/kg b.w)	27.8 ± 2.89	31.7 ± 3.85 t (+ 14.0 %)	28.6 ± 7.08 t (+ 2.88 %)	34.2 ± 5.61 * (+ 23.0 %)
11	MIX (5.4 gm/kg b.w)	26.7 ± 3.09	31.5 ± 3.19 * (+ 18.0 %)	35.3 ± 6.12 ** (+ 32.2 %)	36.1 ± 4.45 ** (+ 35.2 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

** : Highly Signficant difference from the corresponding control at $p < 0.001$

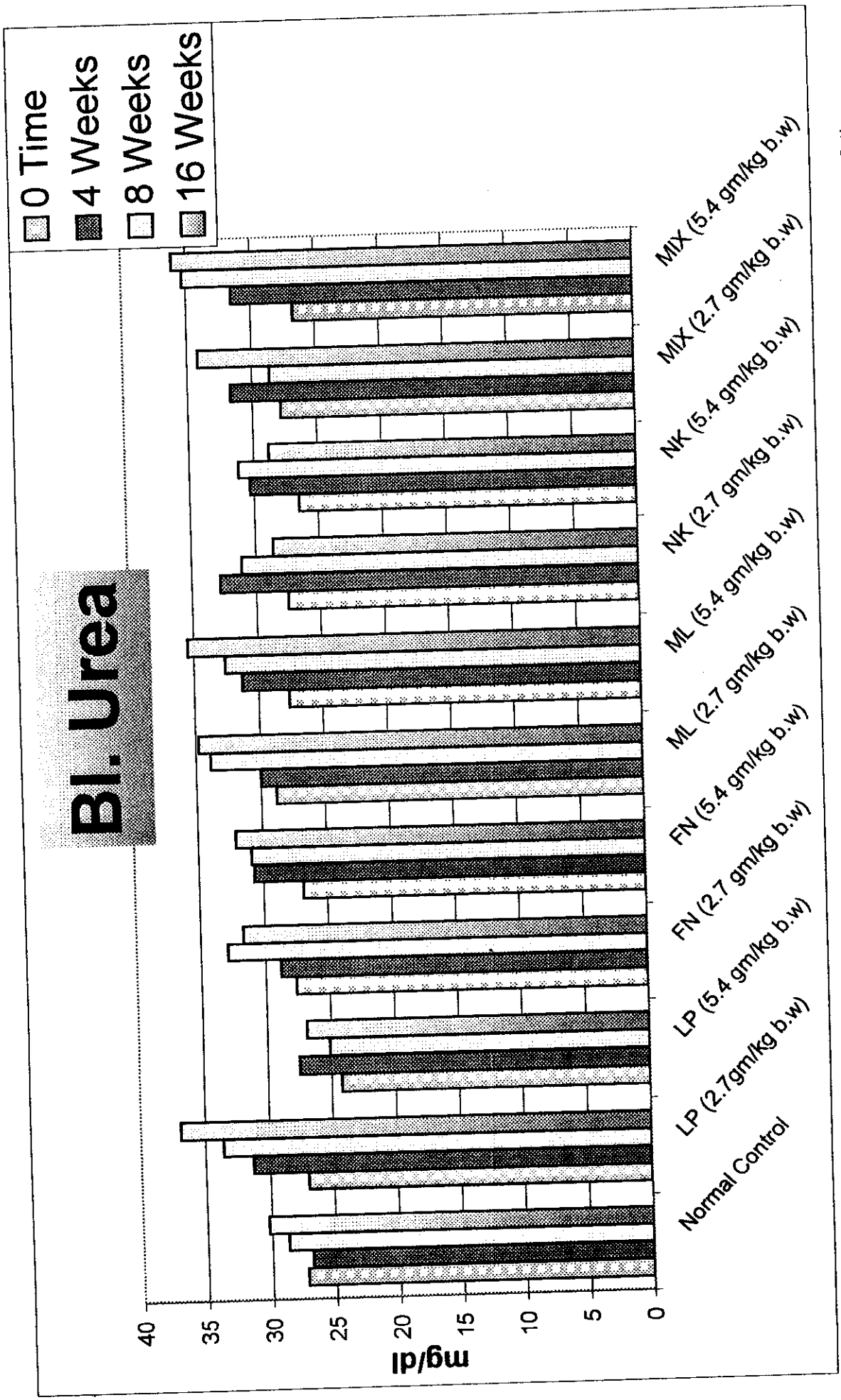


Fig (10) : Blood Urea levels (mg / dl) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (12) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum Creatinine of albino rats .

Gr. No.	Types of treatment	Mean values (mg/dl ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	0.46 ± 0.03	0.48 ± 0.10 t (+ 4.35 %)	0.48 ± 0.12 t (+ 4.35 %)	0.51 ± 0.09 t (+ 10.9 %)
2	LP (2.7gm/kg b.w)	0.59 ± 0.07	0.54 ± 0.05 t (- 8.47 %)	0.57 ± 0.09 t (- 3.39 %)	0.55 ± 0.12 t (- 6.78 %)
3	LP (5.4 gm/kg b.w)	0.53 ± 0.08	0.51 ± 0.05 t (- 3.77 %)	0.49 ± 0.08 t (- 7.55 %)	0.48 ± 0.06 t (- 9.43 %)
4	FN (2.7 gm/kg b.w)	0.62 ± 0.10	0.52 ± 0.05 t (- 16.1 %)	0.60 ± 0.07 t (- 3.22 %)	0.58 ± 0.10 t (- 6.45 %)
5	FN (5.4 gm/kg b.w)	0.62 ± 0.03	0.53 ± 0.51 t (- 14.5 %)	0.58 ± 0.08 t (- 6.45 %)	0.58 ± 0.12 t (- 6.45 %)
6	ML (2.7 gm/kg b.w)	0.53 ± 0.02	0.51 ± 0.07 t (- 3.77 %)	0.55 ± 0.06 t (+ 3.77 %)	0.51 ± 0.11 t (- 3.77 %)
7	ML (5.4 gm/kg b.w)	0.57 ± 0.05	0.54 ± 0.05 t (- 5.26 %)	0.60 ± 0.09 t (+ 5.26 %)	0.58 ± 0.13 t (+ 1.75 %)
8	NK (2.7 gm/kg b.w)	0.58 ± 0.09	0.51 ± 0.05 t (- 12.1 %)	0.64 ± 0.10 t (+ 10.3 %)	0.60 ± 0.12 t (+ 3.45 %)
9	NK (5.4 gm/kg b.w)	0.60 ± 0.07	0.60 ± 0.11 t (0.00 %)	0.57 ± 0.11 t (- 5.00 %)	0.59 ± 0.09 t (- 1.67 %)
10	MIX (2.7 gm/kg b.w)	0.49 ± 0.08	0.58 ± 0.09 t (+18.4 %)	0.59 ± 0.09 t (+ 20.4 %)	0.55 ± 0.11 t (+ 12.2 %)
11	MIX (5.4 gm/kg b.w)	0.64 ± 0.07	0.59 ± 0.13 t (- 7.81 %)	0.53 ± 0.10 t (- 17.2 %)	0.60 ± 0.12 t (- 6.25 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

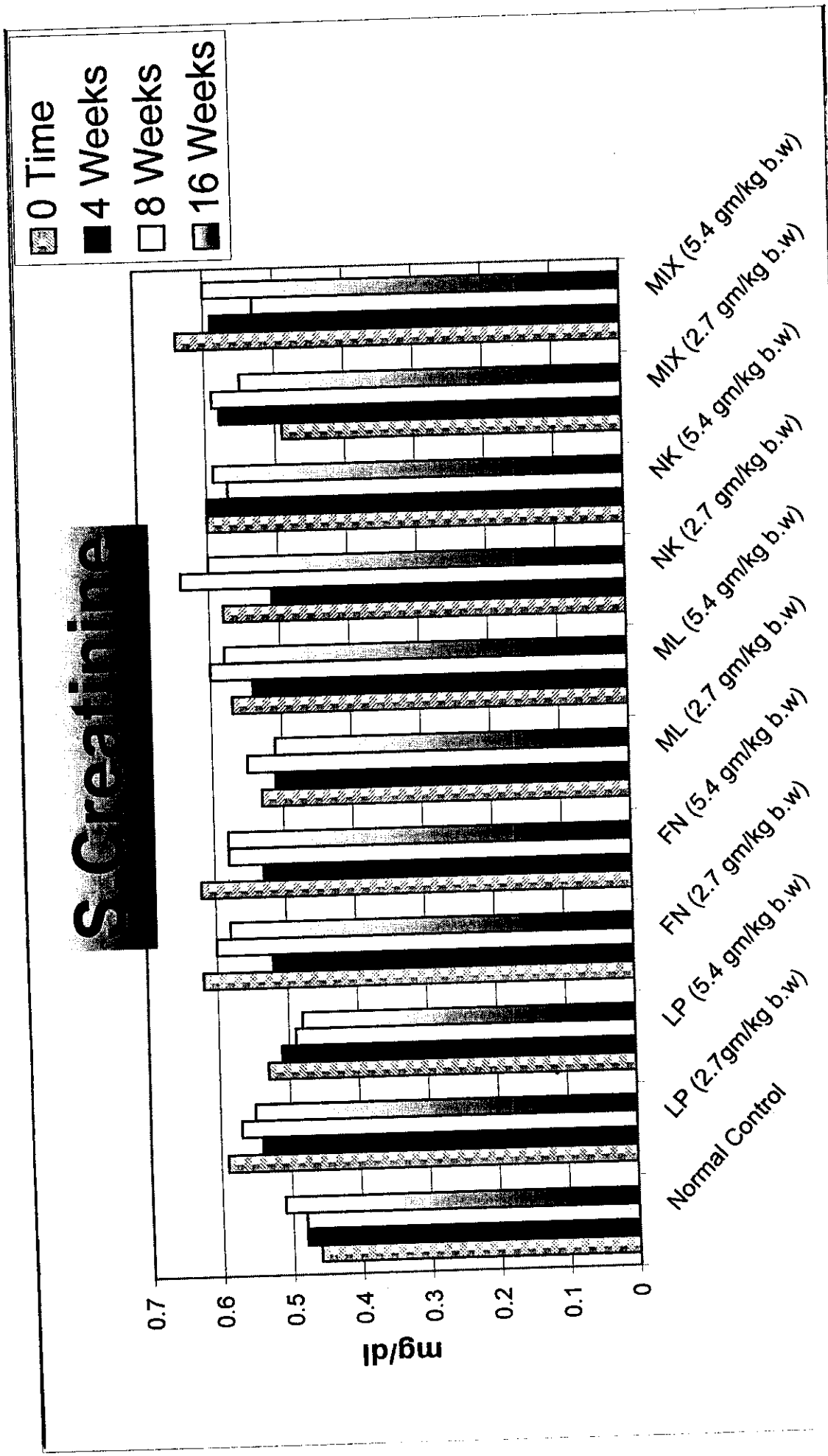


Fig (11) : Creatinine levels (mg/dl) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (13) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum Uric Acid of albino rats .

Gr. No.	Types of treatment	Mean values (mg/dl ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	1.10 ± 0.21	0.97 ± 0.13 t (- 11.8 %)	1.16 ± 0.17 t (+ 5.45 %)	1.00 ± 0.22 t (- 9.09 %)
2	LP (2.7gm/kg b.w)	1.08 ± 0.05	1.08 ± 0.16 t (`0.00 %)	0.98 ± 0.12 t (- 9.26 %)	1.11 ± 0.13 t (+ 2.78 %)
3	LP (5.4 gm/kg b.w)	1.19 ± 0.06	0.94 ± 0.20 * (- 21.0 %)	0.99 ± 0.06 ** (- 16.8 %)	1.20 ± 0.22 t (+ 0.84 %)
4	FN (2.7 gm/kg b.w)	1.05 ± 0.16	1.02 ± 0.14 t (- 2.86 %)	1.08 ± 0.19 t (+ 2.86 %)	1.10 ± 0.18 t (+ 4.76 %)
5	FN (5.4 gm/kg b.w)	1.10 ± 0.16	0.99 ± 0.19 t (- 10.0 %)	1.03 ± 0.18 t (- 6.36 %)	1.00 ± 0.15 t (- 9.09 %)
6	ML (2.7 gm/kg b.w)	1.09 ± 0.21	0.96 ± 0.16 t (- 11.9 %)	1.11 ± 0.23 t (+ 1.83 %)	1.14 ± 0.09 t (+ 4.59 %)
7	ML (5.4 gm/kg b.w)	1.12 ± 0.21	1.17 ± 0.07 t (+ 4.46 %)	1.04 ± 0.14 t (- 7.14 %)	1.11 ± 0.10 t (- 0.89 %)
8	NK (2.7 gm/kg b.w)	1.11 ± 0.21	1.06 ± 0.13 t (- 4.50 %)	0.93 ± 0.20 t (- 16.2 %)	1.14 ± 0.12 t (+ 2.70 %)
9	NK (5.4 gm/kg b.w)	1.02 ± 0.17	0.80 ± 0.08 * (- 21.6 %)	1.09 ± 0.18 t (+ 6.86 %)	1.05 ± 0.11 t (+ 2.94 %)
10	MIX (2.7 gm/kg b.w)	1.17 ± 0.17	1.18 ± 0.16 t (+ 0.85 %)	1.17 ± 0.25 t (`0.00 %)	1.19 ± 0.14 t (+ 1.71 %)
11	MIX (5.4 gm/kg b.w)	1.15 ± 0.23	1.08 ± 0.11 t (- 6.09 %)	1.17 ± 0.15 t (+ 1.74 %)	1.20 ± 0.17 t (+ 4.35 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

** : Highly signficant difference from the corresponding control at $p < 0.001$

Table (14) : Percent variations and statistical [illegible]

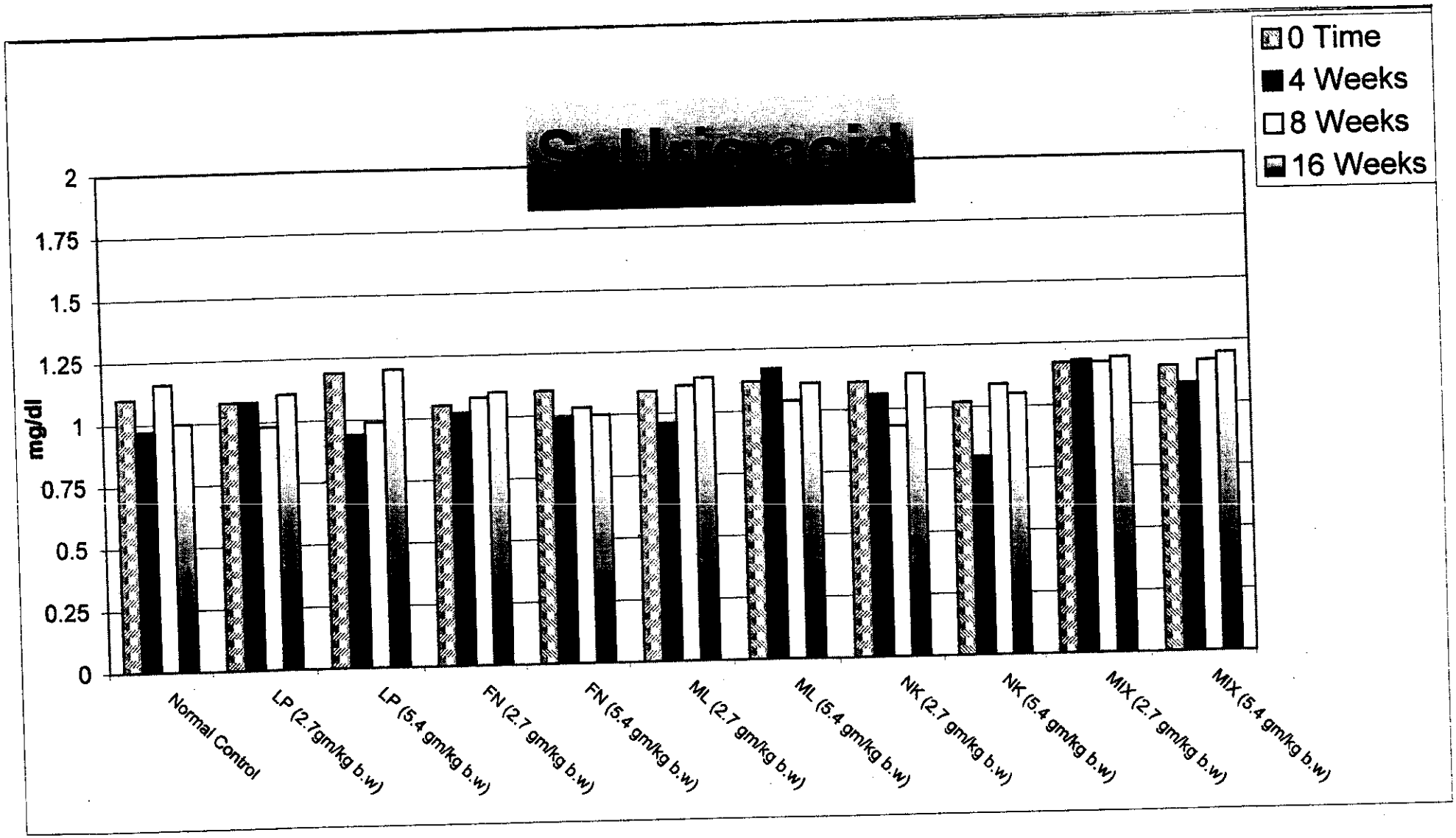


Fig (12) : Uric acid levels (mg / dl) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (14) : Percent variations and statistical significance of differences indced by the effect of different treatments on Serum Inorganic Phosphorus of albino rats .

Gr. No.	Types of treatment	Mean values (mg/dl ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	5.84 ± 0.84	5.10 ± 0.44 * (- 12.7 %)	6.10 ± 0.41 t (+ 4.45 %)	5.94 ± 1.40 t (+ 1.71 %)
2	LP (2.7 gm/kg b.w)	5.52 ± 0.94	5.00 ± 0.93 t (- 9.42 %)	5.42 ± 0.51 t (- 1.81 %)	4.94 ± 1.11 t (- 10.5 %)
3	LP (5.4 gm/kg b.w)	5.60 ± 0.52	5.52 ± 0.44 t (- 1.43 %)	4.81 ± 0.78 t (- 14.1 %)	5.25 ± 1.25 t (- 6.25 %)
4	FN (2.7 gm/kg b.w)	5.50 ± 0.61	4.81± 0.24 t (- 12.5 %)	5.33 ± 0.62 t (- 3.09 %)	5.48 ± 0.99 t (- 0.36 %)
5	FN (5.4 gm/kg b.w)	5.73 ± 1.27	4.88 ± 0.54 t (- 14.8 %)	4.82 ± 0.50 t (- 15.9 %)	5.93 ± 0.83 t (+ 3.49 %)
6	ML (2.7 gm/kg b.w)	4.87 ± 0.53	4.73 ± 0.52 t (- 2.87 %)	5.63 ± 0.94 t (+ 15.6 %)	4.87 ± 0.84 t (`0.00 %)
7	ML (5.4 gm/kg b.w)	4.80 ± 0.69	4.62 ± 0.67 t (- 3.75 %)	5.02 ± 0.45 t (+ 4.58 %)	4.40 ± 1.01 t (- 8.33 %)
8	NK (2.7 gm/kg b.w)	5.33 ± 0.99	4.81 ± 0.22 t (- 9.76 %)	5.11 ± 0.49 t (- 4.13 %)	4.56 ± 0.57 t (- 14.4 %)
9	NK (5.4 gm/kg b.w)	4.88 ± 0.66	4.35 ± 0.19 t (- 10.9 %)	5.21 ± 0.39 t (+ 6.76 %)	5.08 ± 0.55 t (+ 4.10 %)
10	MIX (2.7 gm/kg b.w)	4.83 ± 0.67	4.81± 0.27 t (- 0.41 %)	4.60 ± 0.54 t (- 4.76 %)	4.43 ± 0.71 t (- 8.28 %)
11	MIX (5.4 gm/kg b.w)	5.02 ± 0.68	4.94 ± 0.41 t (- 1.59 %)	5.21 ± 0.59 t (+ 3.78 %)	5.17 ± 0.65 t (+ 2.99 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

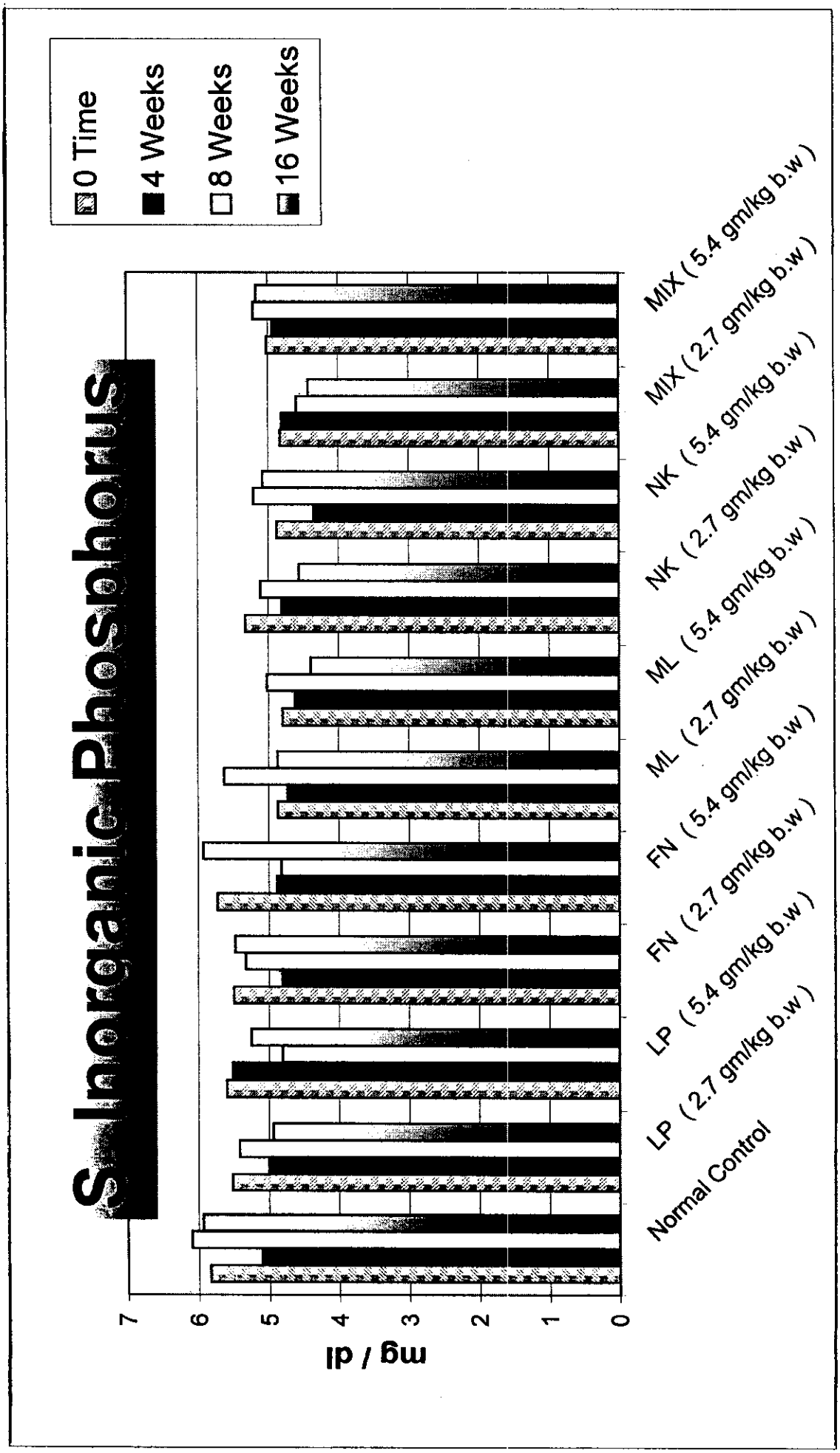


Fig (13) : Inorganic Phosphorus levels (mg / dl) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (15) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum Total Calcium of albino rats .

Gr. No.	Types of treatment	Mean values (mg/dl ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	10.6 ± 0.42	10.1 ± 0.73 t (- 4.72 %)	10.1 ± 0.39 t (- 4.72 %)	10.9 ± 0.31 t (+ 2.83 %)
2	LP (2.7gm/kg b.w)	10.3 ± 1.01	10.4 ± 0.47 t (+ 0.97 %)	12.4 ± 1.28 ** (+ 20.4 %)	12.3 ± 0.86 ** (+ 19.4 %)
3	LP (5.4 gm/kg b.w)	10.1 ± 0.21	9.90 ± 0.92 t (- 1.98 %)	12.7 ± 0.38 ** (+ 25.7 %)	12.0 ± 0.83 ** (+ 18.8 %)
4	FN (2.7 gm/kg b.w)	10.6 ± 0.38	10.9 ± 0.20 t (+ 2.83 %)	11.2 ± 0.48 t (+ 5.66 %)	10.9 ± 0.76 t (+ 2.83 %)
5	FN (5.4 gm/kg b.w)	10.8 ± 0.23	10.1 ± 0.75 t (- 6.48 %)	11.6 ± 1.11 t (+ 7.41 %)	10.7 ± 0.83 t (- 0.93 %)
6	ML (2.7 gm/kg b.w)	10.7 ± 0.16	10.2 ± 1.47 t (- 4.67 %)	10.9 ± 0.76 t (+ 1.87 %)	11.1 ± 0.65 t (+ 3.74 %)
7	ML (5.4 gm/kg b.w)	10.6 ± 0.26	10.5 ± 0.85 t (- 0.94 %)	11.4 ± 0.85 t (+ 7.55 %)	10.8 ± 0.42 t (+ 1.89 %)
8	NK (2.7 gm/kg b.w)	10.3 ± 0.31	10.0 ± 1.20 t (- 2.91 %)	11.7 ± 1.13 * (+ 13.6 %)	11.0 ± 0.80 t (+ 6.80 %)
9	NK (5.4 gm/kg b.w)	9.80 ± 0.41	10.6 ± 0.80 t (+ 8.16 %)	12.0 ± 0.96 ** (+ 22.4 %)	11.8 ± 0.81 ** (+ 20.4 %)
10	MIX (2.7 gm/kg b.w)	10.3 ± 2.01	10.1 ± 0.66 t (- 1.94 %)	12.1 ± 0.55 t (+ 17.5 %)	12.0 ± 1.48 t (+ 16.5 %)
11	MIX (5.4 gm/kg b.w)	10.6 ± 1.91	10.2 ± 0.64 t (- 3.77 %)	9.71 ± 0.48 t (- 8.40 %)	11.6 ± 0.83 t (+ 9.43 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

** : Highly Signficant difference from the corresponding control at $p < 0.001$

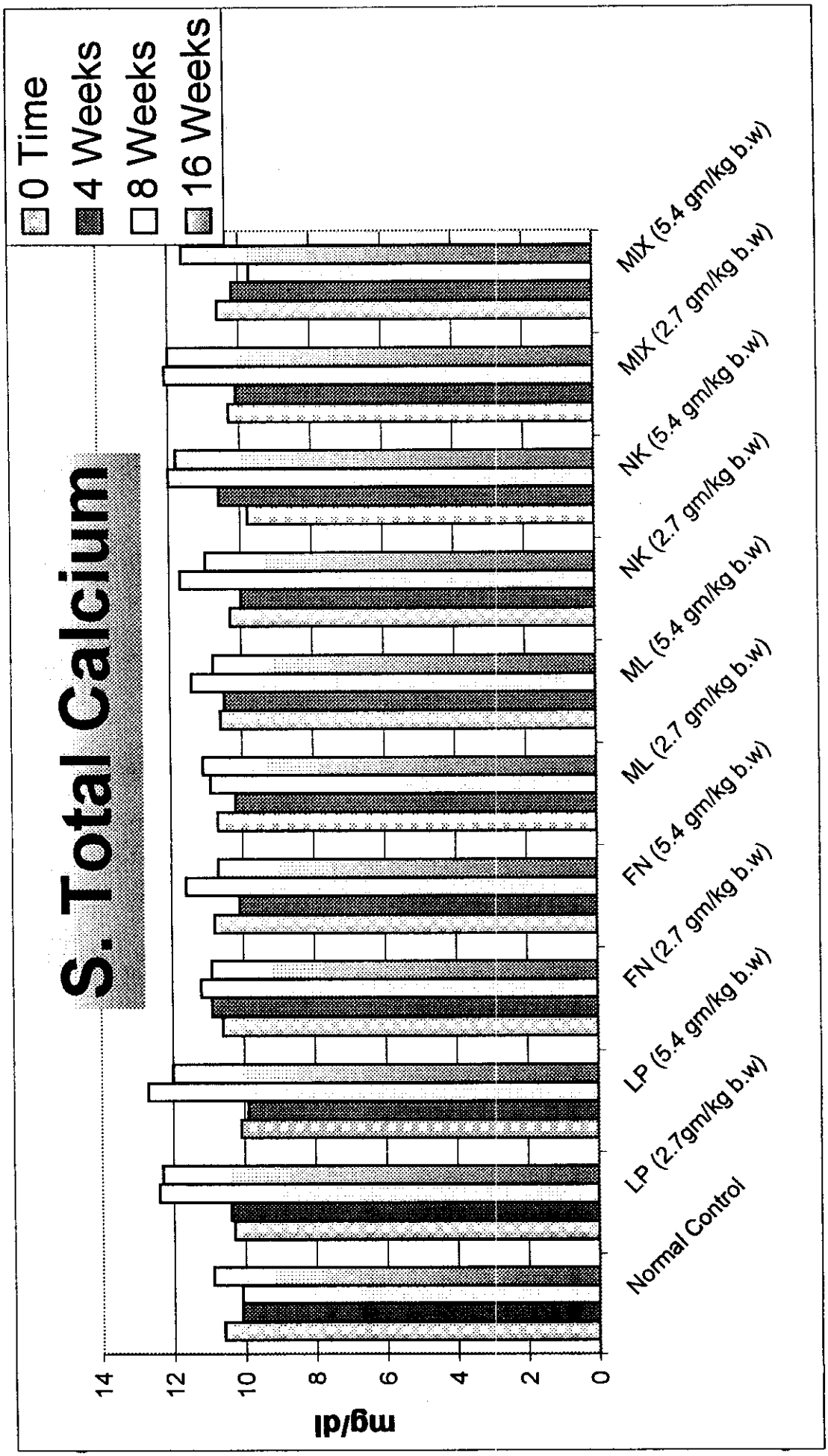


Fig (14): Total Calcium levels (mg / dl) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (16) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum Ionized Calcium of albino rats .

Gr. No.	Types of treatment	Mean values (mmo/L ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	1.23 ± 0.03	1.43 ± 0.15 t (+ 16.3 %)	1.35 ± 0.10 t (+ 9.76 %)	1.31 ± 0.04 t (+ 6.50 %)
2	LP (2.7 gm/kg b.w)	1.00 ± 0.12	1.29 ± 0.05 * (+ 29.0 %)	1.21 ± 0.05 * (+ 21.0 %)	1.12 ± 0.07 t (+ 12.0 %)
3	LP (5.4 gm/kg b.w)	1.16 ± 0.12	1.46 ± 0.12 * (+ 25.8 %)	1.18 ± 0.03 t (+ 1.72 %)	1.19 ± 0.09 t (+ 2.59 %)
4	FN (2.7 gm/kg b.w)	1.17 ± 0.10	1.36 ± 0.14 * (+ 16.2 %)	1.13 ± 0.06 t (- 3.42 %)	1.15 ± 0.10 t (- 1.71 %)
5	FN (5.4 gm/kg b.w)	1.16 ± 0.02	1.35 ± 0.09 * (+ 16.4 %)	1.13 ± 0.02 * (- 2.59 %)	1.18 ± 0.04 t (+ 1.72 %)
6	ML (2.7 gm/kg b.w)	1.26 ± 0.06	1.46 ± 0.13 * (+ 15.9 %)	1.17 ± 0.04 * (- 7.14 %)	1.27 ± 0.10 t (+ 0.79 %)
7	ML (5.4 gm/kg b.w)	1.21 ± 0.09	1.42 ± 0.13 * (+ 17.4 %)	1.17 ± 0.04 t (- 3.31 %)	1.20 ± 0.09 t (- 0.83 %)
8	NK (2.7 gm/kg b.w)	1.19 ± 0.04	1.42 ± 0.09 * (+ 19.3 %)	1.14 ± 0.03 * (- 4.20 %)	1.19 ± 0.08 t (0.00 %)
9	NK (5.4 gm/kg b.w)	1.12 ± 0.05	1.34 ± 0.17 * (+ 19.6 %)	1.10 ± 0.03 t (- 1.79 %)	1.11 ± 0.10 t (- 0.89 %)
10	MIX (2.7 gm/kg b.w)	1.21 ± 0.06	1.34 ± 0.10 * (+ 10.7 %)	1.15 ± 0.04 t (- 4.96 %)	1.19 ± 0.07 t (- 1.65 %)
11	MIX (5.4 gm/kg b.w)	1.09 ± 0.11	1.28 ± 0.07 * (+ 17.4 %)	1.05 ± 0.16 t (- 3.67 %)	1.10 ± 0.10 t (+ 0.92 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

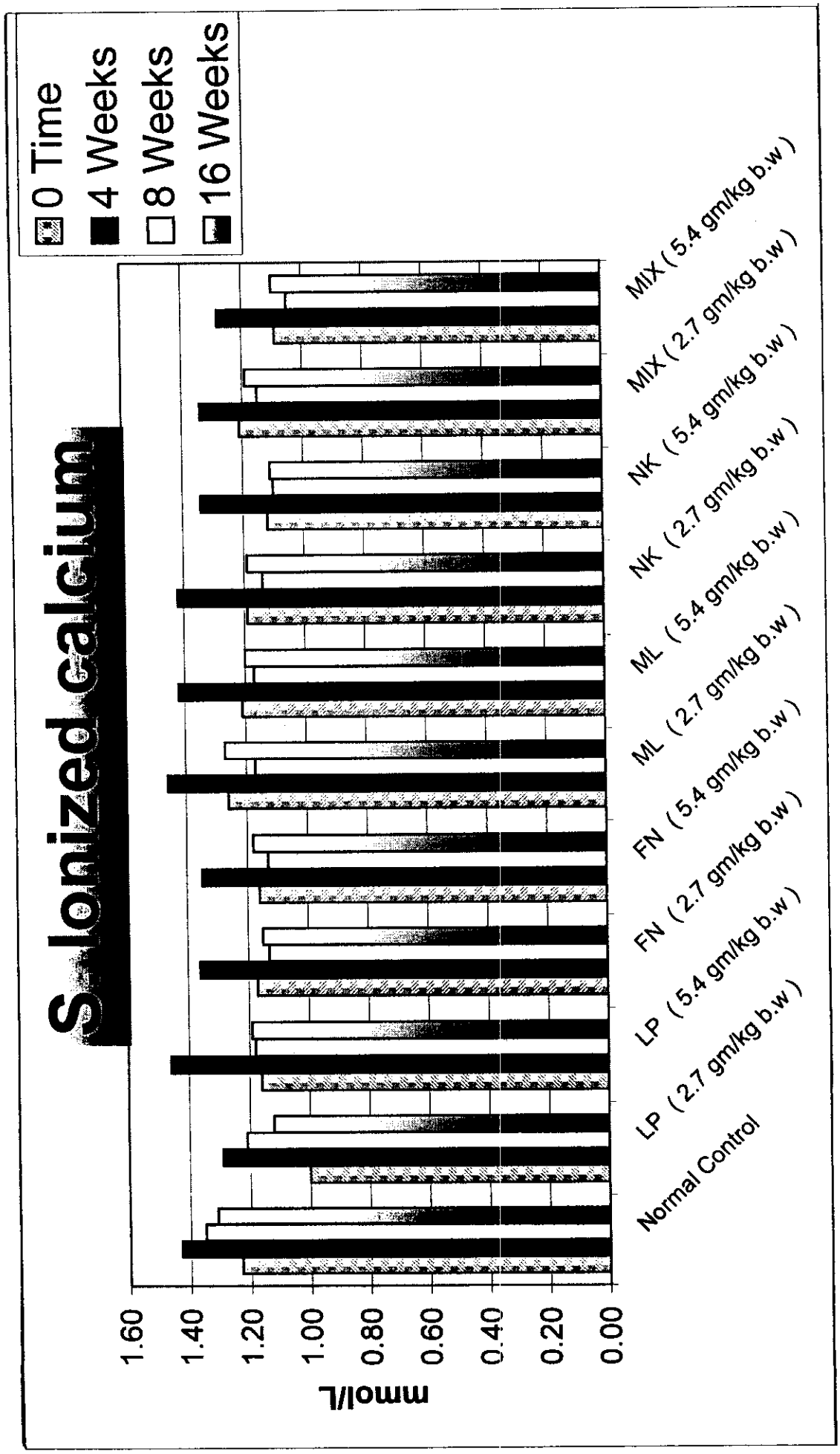


Fig (15) : Ionized calcium levels (mmol/L) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (17) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum Sodium of albino rats .

Gr. No.	Types of treatment	Mean values (Sod.mmol/L ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	142.9 ± 2.82	140.2 ± 3.47 t (- 1.89 %)	141.0 ± 1.57 t (- 1.33 %)	143.0 ± 4.01 t (+ 0.07 %)
2	LP (2.7 gm/kg b.w)	144.1 ± 1.24	141.2 ± 3.31 t (- 2.01 %)	144.1 ± 2.62 t (`0.00 %)	142.1 ± 3.81 t (- 1.39 %)
3	LP (5.4 gm/kg b.w)	144.5 ± 2.31	140.4 ± 3.57 t (- 2.84 %)	141.9 ± 2.10 t (- 1.80 %)	141.8 ± 2.83 t (- 1.87 %)
4	FN (2.7 gm/kg b.w)	142.9 ± 1.36	141.8 ± 4.32 t (- 0.77 %)	138.9 ± 3.29 * (- 2.80 %)	138.0 ± 4.01 * (- 3.43 %)
5	FN (5.4 gm/kg b.w)	143.1 ± 2.31	139.1 ± 3.24 t (- 2.80 %)	137.6 ± 3.10 * (- 3.84 %)	137.1 ± 3.99 * (- 4.19 %)
6	ML (2.7 gm/kg b.w)	143.3 ± 3.11	143.1 ± 2.65 t (- 0.14 %)	137.8 ± 3.65 * (- 3.84 %)	139.0 ± 4.00 * (- 3.00 %)
7	ML (5.4 gm/kg b.w)	140.8 ± 1.18	140.3 ± 4.49 t (- 0.36 %)	139.2 ± 2.53 t (- 1.14 %)	140.2 ± 3.81 t (- 0.43 %)
8	NK (2.7 gm/kg b.w)	143.2 ± 4.08	142.7 ± 4.15 t (- 0.35 %)	139.6 ± 3.04 t (- 2.51 %)	142.1 ± 3.99 t (- 0.77 %)
9	NK (5.4 gm/kg b.w)	139.5 ± 1.66	141.7 ± 2.58 t (+ 1.58 %)	138.0 ± 1.86 t (- 1.08 %)	140.2 ± 2.81 t (+ 0.50 %)
10	MIX (2.7 gm/kg b.w)	141.6 ± 4.21	143.5 ± 5.58 t (+ 0.50 %)	139.3 ± 3.00 t (- 1.62 %)	139.9 ± 3.91 t (- 1.20 %)
11	MIX (5.4 gm/kg b.w)	138.8 ± 3.78	144.9 ± 3.91 * (+ 4.39 %)	135.2 ± 2.05 t (- 2.59 %)	137.2 ± 2.91 t (- 1.15 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

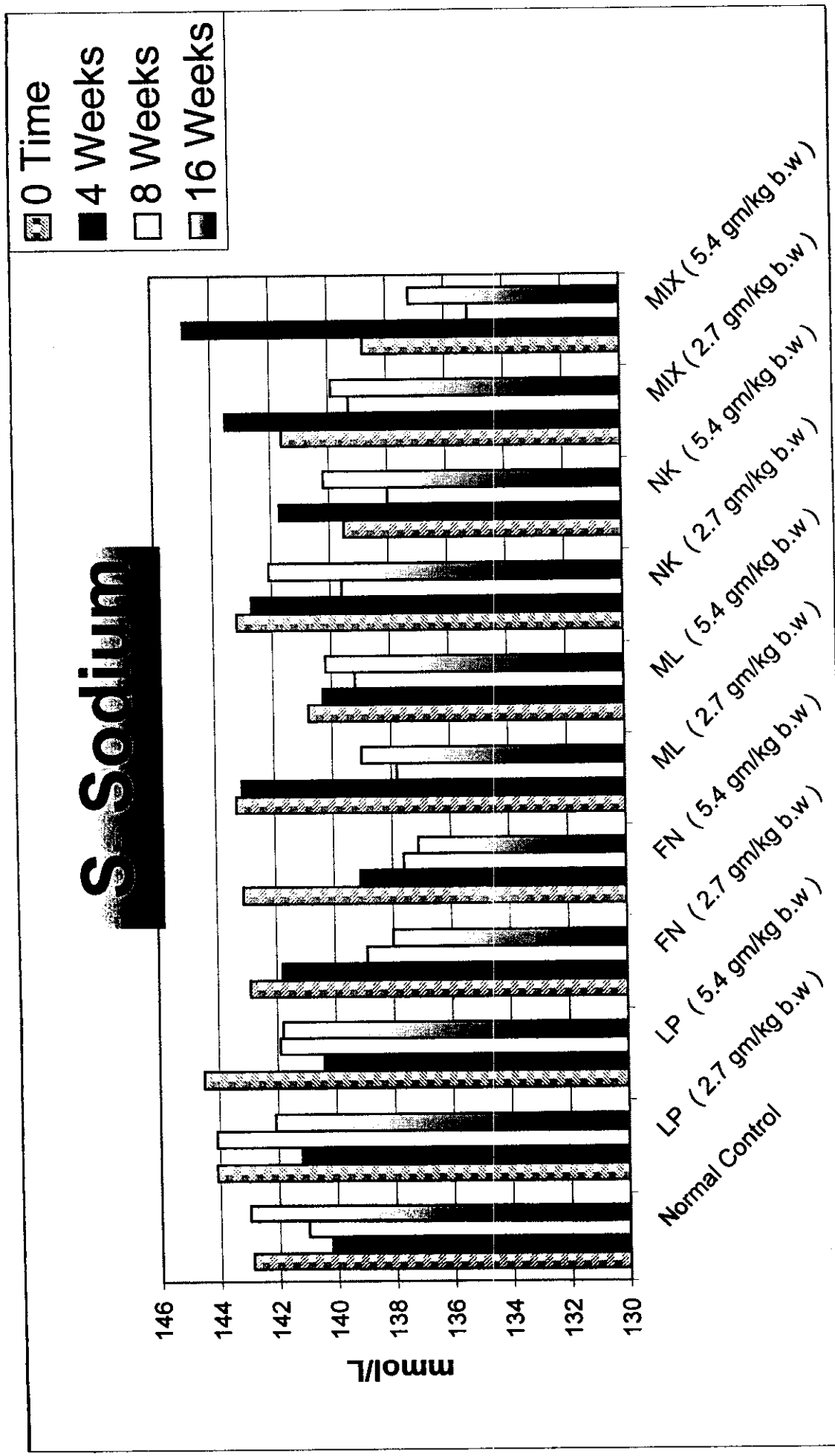


Fig (16) : Sodium levels (mmol/L) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (18) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum Potassium of albino rats .

Gr. No.	Types of treatment	Mean values (mmo/L ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	5.34 ± 0.34	5.30 ± 0.14 t (- 0.75 %)	5.56 ± 0.38 t (+ 4.12 %)	5.42 ± 0.41 t (+ 1.50 %)
2	LP (2.7 gm/kg b.w)	5.75 ± 0.44	5.41 ± 0.59 t (- 5.91 %)	4.77 ± 0.33 * (- 17.0 %)	5.71 ± 0.38 t (- 0.70 %)
3	LP (5.4 gm/kg b.w)	5.64 ± 0.67	5.31 ± 0.26 t -5.85%	5.15 ± 0.40 t (- 8.69 %)	5.00 ± 0.31 t (- 11.3 %)
4	FN (2.7 gm/kg b.w)	5.43 ± 0.40	5.01 ± 0.42 t (- 7.73 %)	5.30 ± 0.52 t (- 2.39 %)	5.12 ± 0.29 t (- 5.71 %)
5	FN (5.4 gm/kg b.w)	5.20 ± 0.75	5.24 ± 0.25 t (+ 0.77 %)	5.05 ± 0.32 t (- 2.88 %)	5.01 ± 0.41 t (- 3.65 %)
6	ML (2.7 gm/kg b.w)	5.68 ± 0.73	5.08 ± 0.41 t (- 10.6 %)	5.26 ± 0.36 t (- 7.39 %)	5.53 ± 0.71 t (- 2.64 %)
7	ML (5.4 gm/kg b.w)	5.46 ± 0.56	5.32 ± 0.55 t (- 2.56 %)	5.06 ± 0.26 t (- 7.33 %)	5.31 ± 0.33 t (- 2.75 %)
8	NK (2.7 gm/kg b.w)	5.49 ± 0.51	5.42 ± 0.60 t (- 1.28 %)	5.31 ± 0.37 t (- 3.28 %)	5.41 ± 0.39 t (- 1.46 %)
9	NK (5.4 gm/kg b.w)	5.88 ± 0.23	5.44 ± 0.45 t (- 7.48 %)	5.82 ± 0.61 t (- 1.02 %)	5.71 ± 0.51 t (- 2.89 %)
10	MIX (2.7 gm/kg b.w)	5.60 ± 0.55	4.25 ± 2.08 t (- 6.25 %)	5.29 ± 0.59 t (- 5.54 %)	5.55 ± 0.49 t (- 0.89 %)
11	MIX (5.4 gm/kg b.w)	5.49 ± 0.40	5.59 ± 0.31 t (+ 1.82 %)	4.95 ± 0.49 t (- 9.84 %)	5.01 ± 0.77 t (- 8.74 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

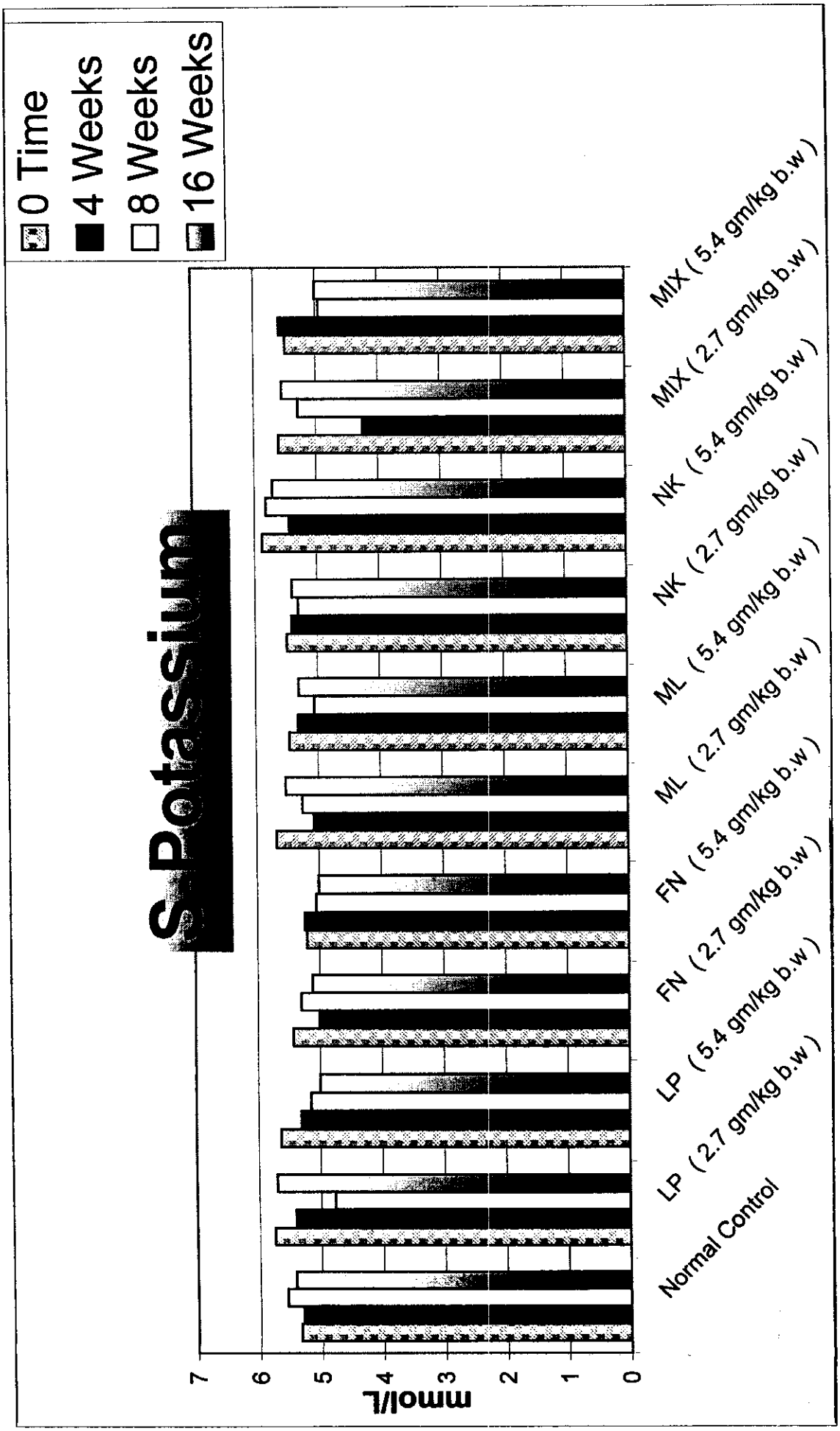


Fig (17) : Potassium levels (mmol/L) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (19) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum Total Cholesterol of albino rats .

Gr. No.	Types of treatment	Mean values (mg/dl ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	72.5 ± 13.8	73.0 ± 11.3 t (+ 0.69 %)	75.8 ± 9.35 t (+ 4.55 %)	74.8 ± 9.05 t (+ 3.17 %)
2	LP (2.7 gm/kg b.w)	72.8 ± 10.3	70.6 ± 10.7 t (- 3.02 %)	80.6 ± 14.5 t (+ 10.7 %)	78.7 ± 13.8 t (+ 8.10 %)
3	LP (5.4 gm/kg b.w)	84.3 ± 7.41	76.8 ± 7.12 t (- 8.90 %)	90.6 ± 8.40 t (+ 7.47 %)	80.8 ± 13.8 t (- 4.15 %)
4	FN (2.7 gm/kg b.w)	80.3 ± 12.9	77.5 ± 8.89 t (- 3.49 %)	88.9 ± 16.0 t (+ 10.7 %)	77.0 ± 13.9 t (- 4.11 %)
5	FN (5.4 gm/kg b.w)	66.8 ± 12.3	77.1 ± 12.5 t (+ 15.4 %)	74.6 ± 13.8 t (+ 11.7 %)	71.5 ± 16.4 t (+ 7.04 %)
6	ML (2.7 gm/kg b.w)	67.7 ± 10.9	73.1 ± 11.2 t (+ 7.98 %)	64.9 ± 10.9 t (- 4.14 %)	81.8 ± 10.9 * (+ 20.8 %)
7	ML (5.4 gm/kg b.w)	75.0 ± 13.1	75.2 ± 10.7 t (+ 0.27 %)	78.8 ± 15.9 t (+ 5.07 %)	83.1 ± 20.1 t (+ 10.8 %)
8	NK (2.7 gm/kg b.w)	78.3 ± 3.91	73.1 ± 5.74 t (- 6.64 %)	82.9 ± 12.1 t (+ 5.87 %)	75.3 ± 10.9 t (- 3.83 %)
9	NK (5.4 gm/kg b.w)	70.3 ± 2.61	70.6 ± 8.12 t (+ 0.43 %)	73.8 ± 8.34 t (+ 4.98 %)	81.2 ± 18.2 t (+ 15.5 %)
10	MIX (2.7 gm/kg b.w)	74.8 ± 7.01	77.2 ± 7.09 t (+ 3.21 %)	79.6 ± 10.2 t (+ 6.42 %)	104.5 ± 23.7 ** (+ 39.7 %)
11	MIX (5.4 gm/kg b.w)	81.4 ± 10.3	81.5 ± 13.3 t (+ 0.12 %)	91.0 ± 14.9 * (+ 11.8 %)	102.4 ± 21.6 * (+ 25.8 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

** : Highly signficant difference from the corresponding control at $p < 0.001$

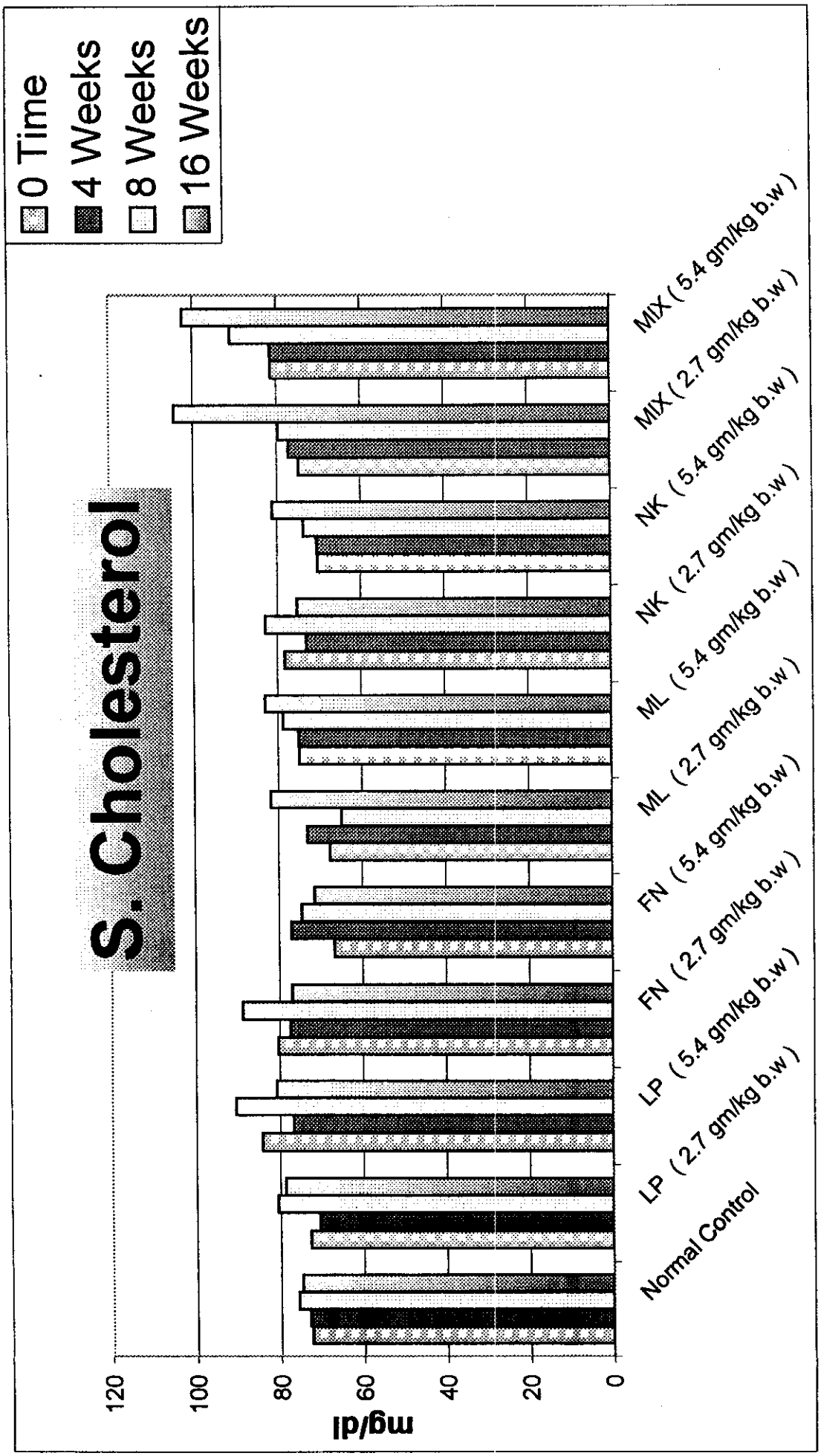


Fig (18) : Cholesterol levels (mg / dl) of different treated animal groups during 16 weeks of treatment compared to 0 time .

Table (20) : Percent variations and statistical significance of differences induced by the effect of different treatments on Serum Triglycerides of albino rats .

Gr. No.	Types of treatment	Mean values (mg/dl ± S.D) and % change from the corresponding control			
		0 Time	4 Weeks	8 Weeks	16 Weeks
1	Normal Control	96.8 ± 23.7	100.1 ± 23.6 t (+ 3.41 %)	91.0 ± 8.99 t (- 5.99 %)	100.7 ± 6.90 t (+ 4.03 %)
2	LP (2.7 gm/kg b.w)	104.5 ± 23.2	102.3 ± 21.2 t (- 2.11 %)	87.4 ± 14.3 t (- 16.4 %)	86.1 ± 14.1 t (- 17.6 %)
3	LP (5.4 gm/kg b.w)	103.5 ± 17.7	111.0 ± 21.7 t (+ 7.25 %)	90.6 ± 15.1 t (- 12.5 %)	89.7 ± 15.7 t (- 13.3 %)
4	FN (2.7 gm/kg b.w)	97.8 ± 14.4	103.1 ± 21.2 t (+ 5.42 %)	97.5 ± 4.65 t (- 0.31 %)	89.5 ± 14.6 t (- 8.49 %)
5	FN (5.4 gm/kg b.w)	96.6 ± 12.9	100.3 ± 19.1 t (+ 3.83 %)	88.8 ± 14.7 t (- 8.07 %)	87.7 ± 10.1 t (- 9.21 %)
6	ML (2.7 gm/kg b.w)	99.0 ± 21.7	107.6 ± 22.1 t (+ 8.69 %)	72.8 ± 14.3 * (- 26.5 %)	88.8 ± 9.29 t (- 10.3 %)
7	ML (5.4 gm/kg b.w)	108.0 ± 11.8	91.2 ± 11.2 t (- 15.6 %)	94.0 ± 7.79 t (- 12.9 %)	99.9 ± 8.08 t (- 7.50 %)
8	NK (2.7 gm/kg b.w)	105.5 ± 19.3	89.0 ± 20.8 t (- 15.6 %)	91.0 ± 17.3 t (- 13.7 %)	85.8 ± 9.38 t (- 18.7 %)
9	NK (5.4 gm/kg b.w)	94.2 ± 19.2	89.2 ± 19.4 t (- 5.31 %)	84.2 ± 15.0 t (- 10.6 %)	92.4 ± 15.1 t (- 1.91 %)
10	MIX (2.7 gm/kg b.w)	115.0 ± 25.7	93.0 ± 19.8 t (- 19.1 %)	96.0 ± 12.1 t (- 16.5 %)	112.0 ± 11.2 t (- 2.61 %)
11	MIX (5.4 gm/kg b.w)	107.8 ± 18.5	95.3 ± 19.3 t (- 11.6 %)	96.4 ± 14.1 t (- 10.6 %)	98.1 ± 9.38 t (- 8.99 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

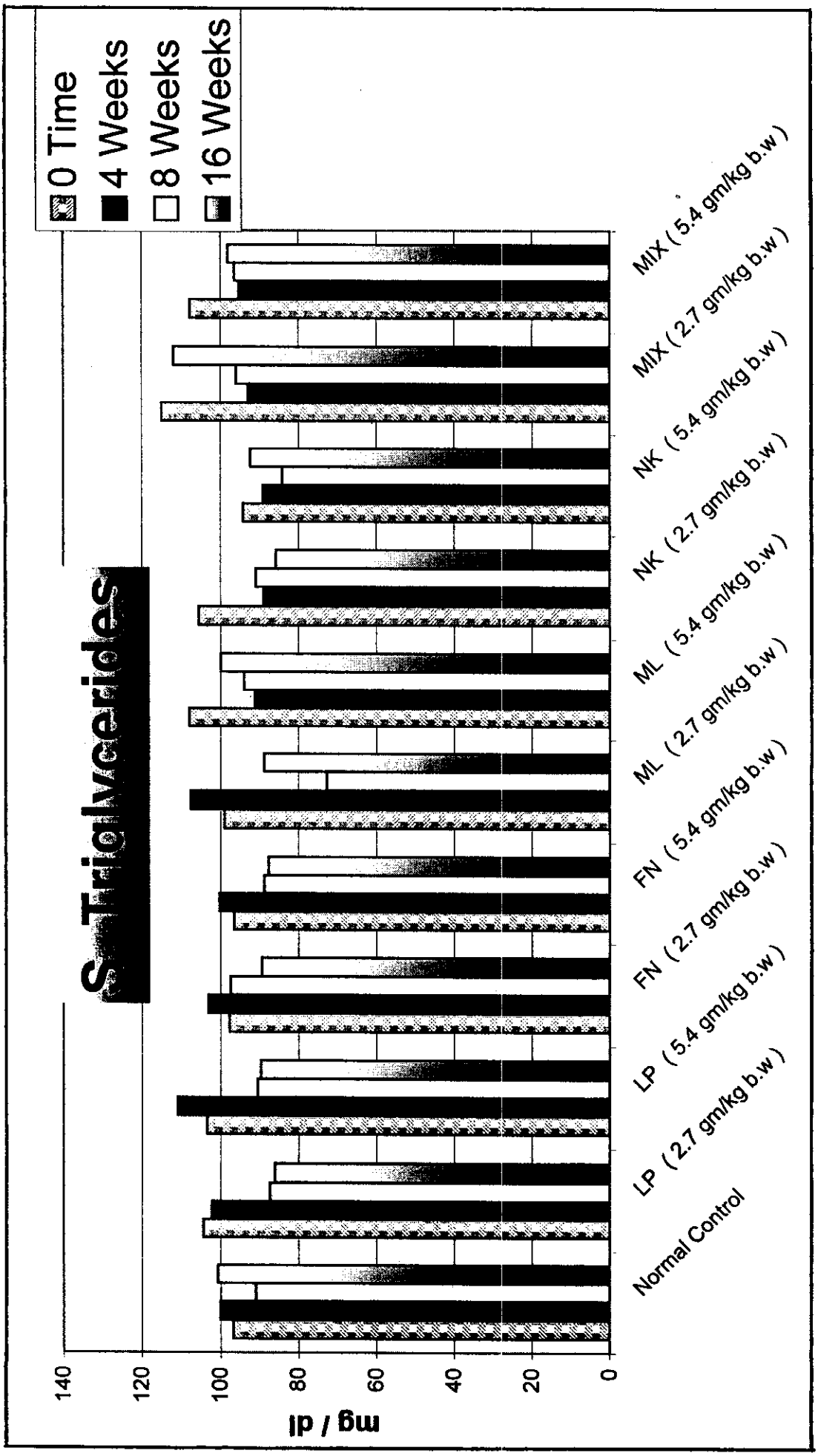


Fig (19) : Triglycerides levels (mg / dl) of different treated animal groups during 16 weeks of treatment compared to 0 time .

2. Protective effect of different plants .

In this part of thesis, rats were injected with STZ after the exposure for 16 wks to different treatments in order to detect which plants provide a protective effect against experimental hyperglycemia.

It is clearly shown from Tables (21&22) and Figs. (20-22) that STZ caused a significant increase in bl.glucose after 3 days of treatment from 102.3 mg/dl to 132.2mg/dl and then this level was fallen to 126.7mg/dl after 1 wk and raised I[to 149.1mg/dl after 2 wks from STZ injection. This means that STZ caused a significant increase in bl. Sugar by 45.7% after 2 wks of treatment compared to the negative control group. The other groups which received the different plant treatments were displayed a variable response comparined to the positive control group of rats (Table 21). The bl. Sugar level of the rats which received LP in a doses of 2.7 & 5.4 gm/kg /b.w was increased by 42.9% and 28.8%, respectively after 2 wks from STZ injection The Corresponding dose of. FN caused an increase of bl.sugar level by 18.5% and 32.0% respectively. ML in a dose of 2.7 gm/kg b.w caused an increase in bl. glucose by 24.2% while the dose of 5.4 gm/kg b.w did not alter the bl. Sugar content. Also, NK (2.7 gm/kg b.w) raised the bl. Sugar by 42.2% as compared with the negative control while the dose of 5.4 gm/kg b.w did not significantly affect the level of bl. glucose. The MIX caused an increases of34.5% and 11.1%, respectively after 2 wks of STZ injection. It was concluded that NK leaves and ML leaves at a dose of 5.4 gm /kg b.w are of the most pronounced effect as a protective substances against the experimental hyperglycemia. The hypoglycemic effect of these plants

is may due to the presence of flavonoids, glycoproteins and alkaloids (Nomura et al., 1982; Rashwan, 1986).

It was also clearly shown from Tables(21&22) and Figs(20&22) that the initial dose of 27.5 mg STZ /kg b.w followed by the booster dose of 11.25 mg/kg b.w induced a well sustainable and prolonged hyperglycemia.

STZ is widely used to induce experimental hyperglycemia due to its high specific cytotoxic effect on the pancreatic beta cells (Rakieten et al., 1963; Arison et al., 1967). STZ-diabetic animals exhibited pathophysiological symptoms of uncontrolled diabetes including hyperglycemia, hypo-insulinemia,, polydipsia, polyuria and glucosuria (Topping and Targ, 1975). However, several factors appeared to affect the efficacy, stability and the duration of action of STZ as a diabetogenic agent. Among these factors, the dose employed seems to be of great importance (Junod et al., 1969). The initial dose of 27.5mg/kg b.w was found to be active, save and caused permanent and significant increase in the blood sugar level.

Several factors have been proved to affect the stability and the potency of STZ such as pH, temperature, buffering system as well as the time elapsed between the start of STZ dissolution and injection (Axler, 1982). It has been found by the author that the diabetogenic action of STZ may decrease by incubating it in saline or distilled water at 56°C. Although saline solution could be used for STZ dissolution yet, its action may be improved by dissolving it in citrate buffer (pH 4.5). Moreover,

a period of more than 5 min between the preparation of the fresh STZ solution and its injection to the test animals may cause sudden drop in the STZ activity (Axler, 1982). Consequently, the restricted method in the present study for the preparation of STZ is essential to attain proper diabetogenic effect. Therefore, the variations and wide range of discrepances from one author to another may be attributed to the above mentioned factors.

3. Curative effect of different plants.

Tables (23&24) and Fig's (23-25) reveal the curative effect of different treatments against hyperglycemia. In this part of thesis, STZ was S.C injected in a dose equivalent to 27.5 mg/kg b.w. and then followed by 3 successive booster doses (every week) each one equivalent to 11.25 mg/kg b.w. It was clearly shown that STZ caused a very highly significant increase in bl. sugar level during the course of treatment. After 4 weeks of treatments, bl. glucose was increased by 42.2% compared to initial level.

Two standard hypoglycemic agents were used in order to evaluate the different treatments throughout the course of experiment. These two drugs are Diamicron "from the sulfonylureas group" and it was injected to rats in a dose equivalent to 14.4 mg/kg b.w and the other is Metaformin "from the biguanides group" which was injected in a dose of 45 mg/kg b.w. These drugs were orally administered daily during the 4 weeks of experiment as the same manner as the different plants treatments to the experimental animals.

Table (21) : Blood Glucose levels (mg/dl ± S.D) and % variation of different treated groups compared with positive control rats at different time intervals .

Types of Treatment	0 Time		3 Day's	7 Day's		14 Day's
Pos - control	102.3 ± 11.4		132.2 ± 20.1	126.7 ± 17.0		149.1 ± 27.2
LP (2.7gm/kg b.w)	99.0 ± 8.99	STZ (Initial dose 27.5 mg / kg b.w)	117.4 ± 12.1 t (- 11.2 %)	104.9 ± 12.9 * (- 17.2 %)	STZ (booster dose 11.25 mg / kg b.w)	141.5 ± 13.9 t (- 5.10 %)
LP (5.4 gm/kg b.w)	100.9 ± 14.9		120.4 ± 10.8 t (- 9.06 %)	117.7 ± 18.5 t (- 7.10 %)		130.0 ± 11.5 t (- 12.8 %)
FN (2.7 gm/kg b.w)	112.5 ± 10.4		124.3 ± 11.2 t (- 5.98 %)	138.7 ± 17.3 t (+ 8.65 %)		133.3 ± 5.48 t (- 10.6 %)
FN (5.4 gm/kg b.w)	102.4 ± 9.86		116.0 ± 13.8 t (- 12.2 %)	122.1 ± 8.41 t (- 3.63 %)		135.2 ± 2.61 t (- 9.32 %)
ML (2.7 gm/kg b.w)	94.5 ± 7.70		135.8 ± 5.68 t (+ 2.65 %)	128.6 ± 11.2 t (+ 1.47 %)		117.4 ± 5.80 ** (- 21.3 %)
ML (5.4 gm/kg b.w)	105.5 ± 9.85		138.8 ± 19.0 t (+ 4.76 %)	129.0 ± 25.2 t (+ 1.78 %)		113.9 ± 14.3 ** (- 23.6 %)
NK (2.7 gm/kg b.w)	86.3 ± 12.8		109.7 ± 4.72 * (- 17.0 %)	122.1 ± 12.7 t (- 3.63 %)		114.2 ± 17.0 * (- 23.4 %)
NK (5.4 gm/kg b.w)	95.5 ± 15.9		128.1 ± 23.8 t (- 3.10 %)	127.6 ± 19.1 t (+ 0.71 %)		108.6 ± 8.29 ** (- 27.2 %)
MIX (2.7 gm/kg b.w)	88.1 ± 6.16		12o.9 ± 26.2 t (- 8.55 %)	119.5 ± 14.0 t (- 5.68 %)		111.8 ± 11.4 ** (- 25.0 %)
MIX (5.4 gm/kg b.w)	90.5 ± 6.04		121.3 ± 15.9 t (- 8.25 %)	128.4 ± 16.8 t (+ 1.32 %)		107.2 ± 10.0 ** (- 28.1 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

** : Highly Signficant difference from the corresponding control at $p < 0.001$

Table (22) : Blood Glucose levels (mg/dl ± S.D) and % variation of rats received STZ compared with control rats.

	Neg. Control Rats	Pos. Control Rats
0 Time	102.3 ± 11.4	102.3 ± 11.4
3 Day's	100.1 ± 12.9 t (- 2.15 %)	132.2 ± 20.1 ** (+ 29.2 %)
1 Week	106.5 ± 8.68 t (+ 4.11 %)	126.7 ± 17.0 ** (+ 23.8 %)
2 Week's	104.8 ± 5.16 t (+ 2.44 %)	149.1 ± 27.2 ** (+ 45.7 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

** : Highly Signficant difference from the corresponding control at $p < 0.001$

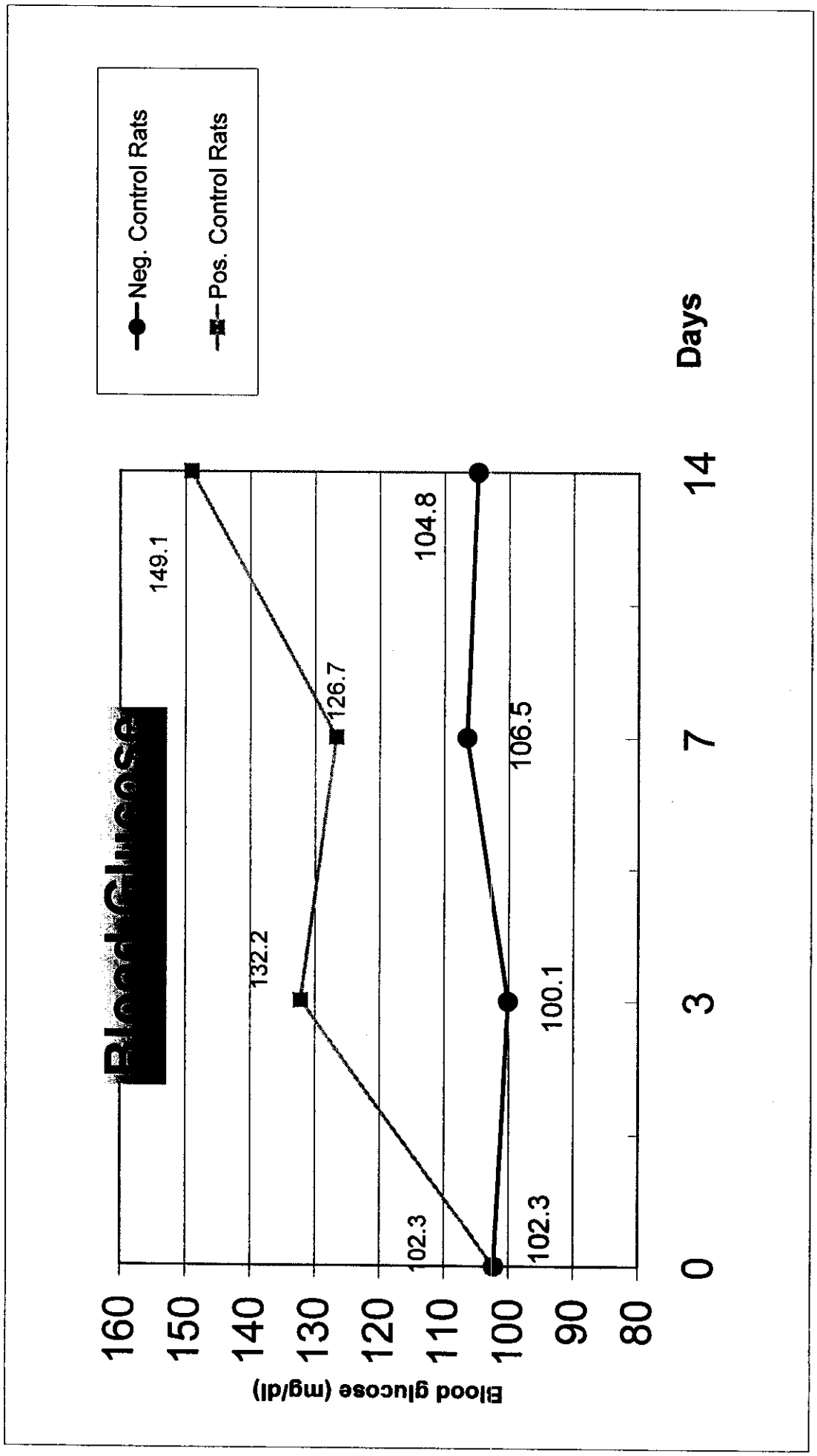


Fig (20) Comparison between blood Glucose levels of positive and negative control groups

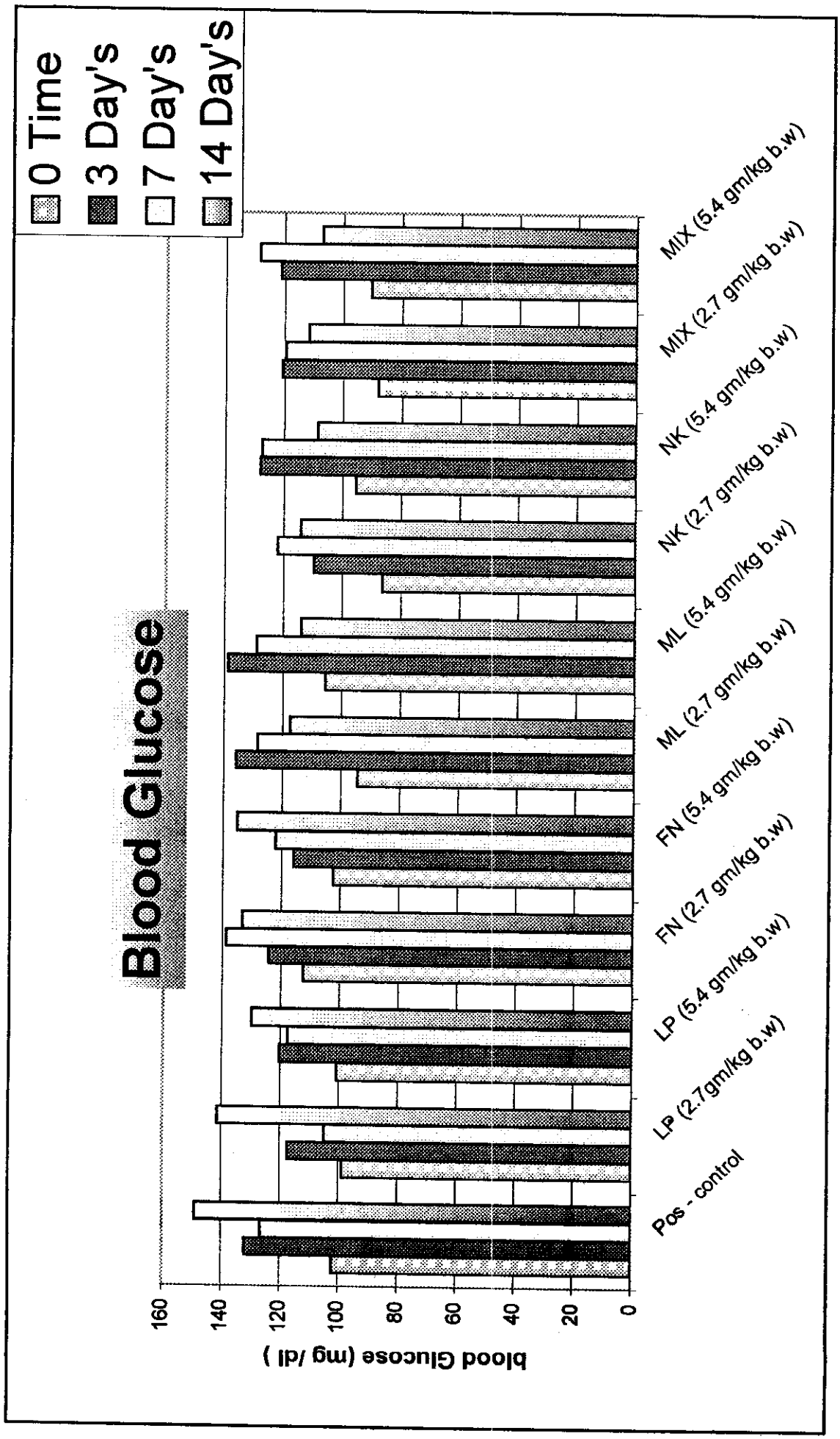


Fig (21) Blood Glucose levels of positive control rats as compared with different treated groups of animals.

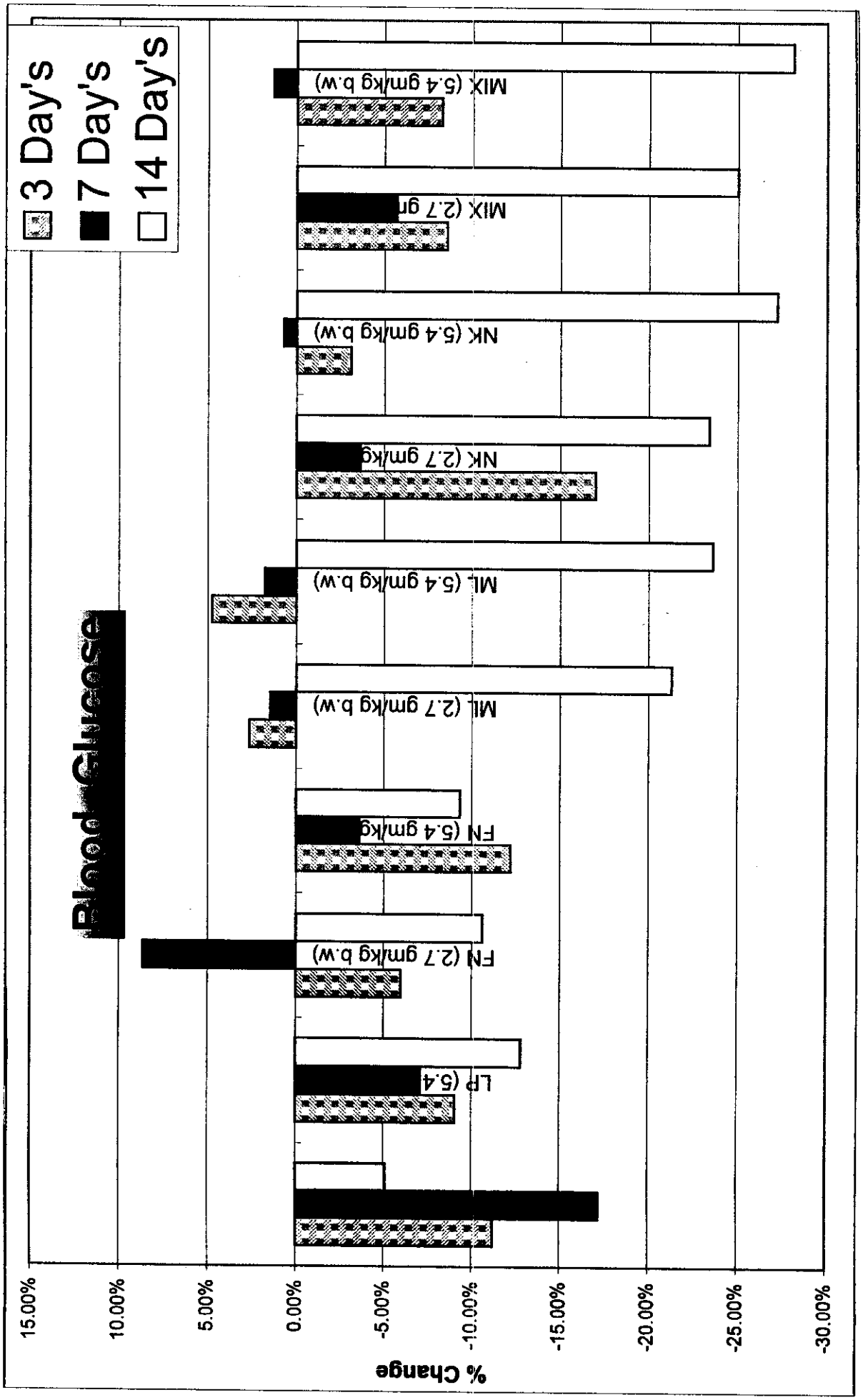


Fig (22) Percent variation of Blood Glucose levels of different treatments compared to positive control rats

Bl.glucose was increased only by 15.4% and 19.3% in the groups of rats which received diamicron and metaformin , respectively after 4 wks of treatment compared to the positive control group in which increased by 42.2%.(Table 23) So the pharmacological action of the standard drugs was clearly pronounced. The effect of the different plants on blood glucose level (Table 24) compared with the reference compounds revealed that the MIX (5.4 gm/kg) and LP (2.7 gm/kg) were more affected the blood sugar level than the other treatments. BL. glucose was increased from 112.1 mg/dl to 122.8 mg/dl (9.5%) and from 110.5 mg/dl to 121.5mg/dl (9.9%), respectively compared to the positive control rats. The other treatments displayed a fluctuated effect between 20-37% compared to the positive control group (42.2%). This means that all the plants used in this study have a tendency to play a role as a hypoglycemic substances. The anti-diabetic effect of the different plants is dependent upon the active constituents and their concentrations as well as the dose and duration of experiment.

Several hypotheses had been suggested to explain the mode of action of biguanides and sulfonylureas. Rieser, 1967 reported that biguanides do not act on insulin secretion but decreases the gastrointestinal absorption of carbohydrate, diversion of glucose towards lactate pathway, decrease gluconeognesis and decrease hepatic glucose production wherease, sulfonylureas drugs stimulates the production of insulin by the pancreatic B-cells, reduced metabolic clearance of insulin, reduced hepatic glucose production and reduced insulin resistance.

Metaformin is a less toxic biguanide which can be a useful treatment for NIDDM (Marles and Fransworth, 1994). So, the current methods for treatment of diabetes mellitus failed to achieve the ideals of normoglycaemia and the prevention of diabetic complications, thus an international focusing is directed towards the herbal treatment of diabetes which can achieve those objectives to a considerable degree. Many herbal teas are said to have antidiabetic activity and are available in the Egyptian markets. The herbal constituents of these teas are widely cultivated in Egypt and are known in folk medicine to be used for the treatment of diabetes.

Gori and Campbell (1998) reported that many natural products are promoted to improve the health status of patients with diabetes by people making a profit on these products. Few of these claims have many scientific basis. Certain natural products are potentially damaging to patients with chronic diseases, especially if the products are used instead of proven scientific treatment regimens. Many individuals believe that if a product is natural it must be effective and safe. Patients should be taught the importance of using proven effective treatment regiments. Any patient who decides to use a natural product should be followed closely to make sure that no toxic effects occured and that treatment objectives are achieved.

Our obtained results concerning the effect of lupin on blood sugar of the STZ diabetic rats are agreement with different workers (Orestano, 1941; Al-Zaid et al., 1991; Ahmed and Esmaiel, 1993). It was reported that lupin contains some alkaloids such as lupinine, angustifoline,

sparteine, anagyrine, lupanine and multiflorine (El-Gayed, 1992). Lupanine is the main alkaloid of the blue and white lupine, while sparteine is the main alkaloid of the yellow lupin. Lupin seeds exerts their hypoglycemic effect via its contents of quinolizidine, lupanine and sparteine.

Some lupin species have high manganese content (Rubenstein et al., 1962). It is known that alfalfa herb exerts a significant hypoglycemic effect most probably due to its high manganese content. So the hypoglycemic effect of LP may be due to its manganese content.

Foenugreek contains several constituents such as alkaloids, saponins, flavonoids, fixed oils ,mucilage, vitamins, mineral, nicotenic acid and nicotinamide (Elujoba and Hardman, 1987).

Foenugreek (FN) seeds exerts their hypoglycemic effect due to alkaloid content, Also, nicotinic acid and nicotinamide may play a role in this direction. Coumarin of FN caused the most effect of hypoglycemia (Chani et al, 1974). The flavonoids present in FN such as vetexin, vetexin-7-glucoside and orientine as well as trigonelline possess significant hypoglycemic action (Abdul-Wahab et al., 1984). The mechanism of hypogycemic activity of trigonelline may be ascribed to its slowdown of the metabolism of nicotinic acid which increases the rate of glucose slowing from the blood by increasing the rate of penetration of glucose from the extra to the intracellular compartment and also by its quick oxidation (Root and Ashmore, 1964).

Mulberry (ML) is the leaves of Morus alba L. and Morus nigro L. Fam. Moraceae known in commerce as white and black tut which commonly cultivated in Egypt in the gardens and by the canals. The preliminary phytochemical screening of the leaves of Morus species revealed the presence of glycosides, flavonoids, unsaturated sterols, triterpenes, tannins, coumarins, volatile substances, cardiac glycosides, oxidase enzymes, anthraquinones (Rashwan, 1986). Further studies of the flavonoidal content of the leaves reveals the presence of morin, quercetrin and rutin. Desphand et al.,1968 isolated another four flavonoids closely related to the artocarpus pigments from M. alba L.e Mulberrin, mulberrochromene, cyclomulberrin and cyclomulberrochromene. In 1982, Nomura et al. isolated three isoprene substituted flavones namely. Kuwanon D,E and F from M.albal.Hikimo, 1985 isolated a glycoprotein " moranA" from the root bark of M. alba L. This glycoprotein has remarkable hypoglycemic activity in normal and alloxan-diabetic mice.

Our results concerning the effect of ML on bl.sugar level are in agreement with the data obtained by sharaf and Fayez, 1964; Azzam, 1984. They reported that the oral administration of 10% aqueous extract of M.alba L.in a dose equivalent to 1g/kg of dried powdered leaves produce approximately the same hypoglycemic effect as tolbutamide (200 mg/kg). The ethyl acetate extract produced hypoglycemic effect half that of tolbutamide. Hammuda, 1989 also reported that mulberry leaves are effective as hypoglycemic agent and the powder or the plant extract must be given for a long time to obtain measurable effects. It seems that mulberry leaves has cumulative effect which depends on continuous

consumption of the extract with the presence of sufficiently large population of healthy B-cells.

Our results reaveld that NK has a significant hypoglycemic effect in the STZ-diabetic rats. These data are in agreement with those obtained by Glombitza et al;, 1994 who reported that NK was significantly reduced bl.Sugar level in STZ-diabetic rats. Also, liver phosphorylase and glucose-6-phosphatase activities were decreased by NK administration.

The hypoglycemic effect of zizyphus is may due to the presense of flavonoids and saponins in leaves. Dharmananda, 1998 reported that the hypoglycemic activity of zizyphus is mainly the result of the influence of saponins called "jujubosides" (which make up 2.5% of the seed). This compound is similar in chemical structure of another saponins present in ganoderma, ginsing, bupleurum and other chinese herbs that are used to treat diabetes.

The use of the MIX of the different plants displayed a significant hypoglycemic effect after 4 wks of treatment without any toxicological effect which could appear when LP, FN, ML or NK will used separately for long period. Unfortunately, this MIX caused a highly significant increase in serum total cholesterol level after 16 wks of treatment.

In general, the hypoglycemic activity of the pre-mentioned plants is due to the presence of active antidiabetic substances such as flavonoids, alkaloids, saponins, glycoproteins, nicotinic acid , nicotinamide and

manganese. Flavonoids seems to act by improving vascularization of the pancrease. Insulin is fixed on proteins of the surface of the cells, thus cellular membranes play an important role in diabetes and vascular troubles develop gradually during the course of the disease entailing a thickening in the basal membranes of the walls of small blood vessels and capillaries and increase in their permeability. Flavonoids found to inhibit or slow down these changes in capillary walls especially in early stages of the disease thus to improve the patient condition through recovary of vascularization of the pancreas (Osuntonkun, 1975; Bever, 1986). Flavonoids have also a potent antioxidant activity and seem to intervene in oxido-reduction phenomena i.e decreases the level of glycosylated hemoglobin in diabetic subjects independantly of changes of plasma glucose which may help in reducing the incidence of diabetic complications (Ceriello et al., 1991).

Trigonelline which is alkaloid present in lupin and foenugreek, is the N-methyl derivative and main human metabolic end-product of nicotinic acid has a weak and transient hypoglycemic effect when administred orally to diabetic patients and acts by slowing the metabolism of niacin (Diab, 1992).

Finally, we highly recommend to carry out further investigations to study the effect of the MIX on lipid pattern of normal and STZ-diabetic animals in short and long period time. Also, another species of experimental animals i.e. rabbits and /or guinea pigs should be used in order to assessment the possibility of using this MIX of Egyptian plants in treatment of diabetic patients.

Table (23) : Blood Glucose levels (mg/dl ± S.D) and % variation of Positive. control rats compared with negative control rats during 4 weeks of treatment

	Neg. Control	Pos.Control
0 Time	99.7 ± 16.9	89.1 ± 7.41
1 wk.	105.0 ± 8.84 t (+ 5.31 %)	178.6 ± 39.6 *** (+ 100.4 %)
2 wks.	105.8 ± 8.86 t (+ 6.12 %)	158.2 ± 15.8 *** (+ 77.6 %)
3 wks.	101.4 ± 7.10 t (+ 1.71 %)	116.7 ± 7.29 *** (+ 31.0 %)
4 wks.	104.9 ± 5.50 t (+ 5.22 %)	126.7 ± 12.1 *** (+ 42.2 %)

t : Insignificant difference from the corresponding control at $p < 0.05$

*** : Very highly Signficant difference from the corresponding control at $p > 0.01$

Table (24) : Blood Glucose levels (mg/dl ± S.D) and % variation of different treatments with positive control animals during 4 weeks of treatment

Types of Treatment	Time intervals (week)				
	0 Time	1	2	3	4
Positive Control	89.1 ± 7.41	178.6 ± 39.6	158.2 ± 15.8	116.7 ± 7.29	126.7 ± 12.1
DIAMICRON (14.4 mg/kg b.w)	103.9 ± 14.4	123.1 ± 17.4 ** (- 31.1 %)	128.5 ± 21.4 * (- 18.8 %)	117.2 ± 8.06 t (+ 0.43 %)	119.9 ± 27.7 t (- 5.37 %)
METFORMIN (45 mg/kg b.w)	98.1 ± 21.9	105.2 ± 14.7 ** (- 41.1 %)	106.7 ± 13.3 *** (- 32.6 %)	106.5 ± 9.93 t (- 8.74 %)	117.0 ± 11.5 t (- 7.66 %)
L.P (2.7 gm/kg b.w)	110.5 ± 8.94	132.5 ± 8.51 ** (- 25.8 %)	120.6 ± 14.7 ** (- 23.8 %)	114.9 ± 9.35 t (- 1.54 %)	121.5 ± 13.9 t (- 4.10 %)
L.P (5.4 gm/kg b.w)	100.0 ± 12.7	117.0 ± 11.7 ** (- 34.5 %)	108.4 ± 12.7 *** (- 31.5 %)	122.3 ± 12.5 t (+ 4.80 %)	124.7 ± 17.4 t (+ 1.58 %)
F.N (2.7 gm/kg b.w)	105.2 ± 13.9	119.1 ± 6.27 ** (- 33.3 %)	153.0 ± 25.6 t (- 3.29 %)	126.6 ± 6.52 * (+ 8.48 %)	132.6 ± 10.9 t (+ 4.66 %)
F.N (5.4 gm/kg b.w)	102.7 ± 6.71	124.1 ± 8.79 ** (- 30.5 %)	150.7 ± 31.6 t (- 4.74 %)	126.9 ± 8.70 * (+ 8.74 %)	128.3 ± 14.3 t (+ 1.26 %)
M.L (2.7 gm/kg b.w)	103.1 ± 5.26	120.3 ± 10.3 ** (- 32.6 %)	113.2 ± 8.41 *** (- 28.4 %)	140.1 ± 15.2 ** (+ 20.1 %)	124.7 ± 9.65 t (- 1.58 %)
M.L (5.4 gm/kg b.w)	106.7 ± 7.02	113.8 ± 10.9 ** (- 36.3 %)	117.2 ± 25.4 ** (- 25.9 %)	138.5 ± 9.02 *** (+ 18.7 %)	131.5 ± 13.6 t (+ 3.79 %)
N.K (2.7 gm/kg b.w)	102.3 ± 8.60	110.8 ± 9.28 ** (- 38.0 %)	120.5 ± 5.38 *** (- 23.8 %)	122.1 ± 4.20 t (+ 4.63 %)	128.6 ± 22.9 t (+ 1.50 %)
N.K (5.4 gm/kg b.w)	101.2 ± 7.22	120.9 ± 17.5 ** (- 32.3 %)	118.3 ± 5.65 *** (- 25.2 %)	157.6 ± 19.2 *** (+ 35.0 %)	128.7 ± 18.9 t (+ 1.58 %)
MIX (2.7 gm/kg b.w)	98.2 ± 6.93	125.1 ± 8.12 ** (- 30.0 %)	120.2 ± 9.98 *** (- 24.0 %)	140.9 ± 20.8 * (+ 20.7 %)	135.1 ± 20.6 t (+ 6.63 %)
MIX (5.4 gm/kg b.w)	112.1 ± 10.2	120.8 ± 9.02 ** (- 32.4 %)	123.4 ± 3.08 *** (- 22.0 %)	128.7 ± 14.7 t (+ 10.3 %)	122.8 ± 22.2 t (- 3.08 %)

STZ (Initial dose 27.5 mg / kg b.w)

STZ (Booster dose 11.25 mg / kg b.w)

STZ (Booster dose 11.25 mg / kg b.w)

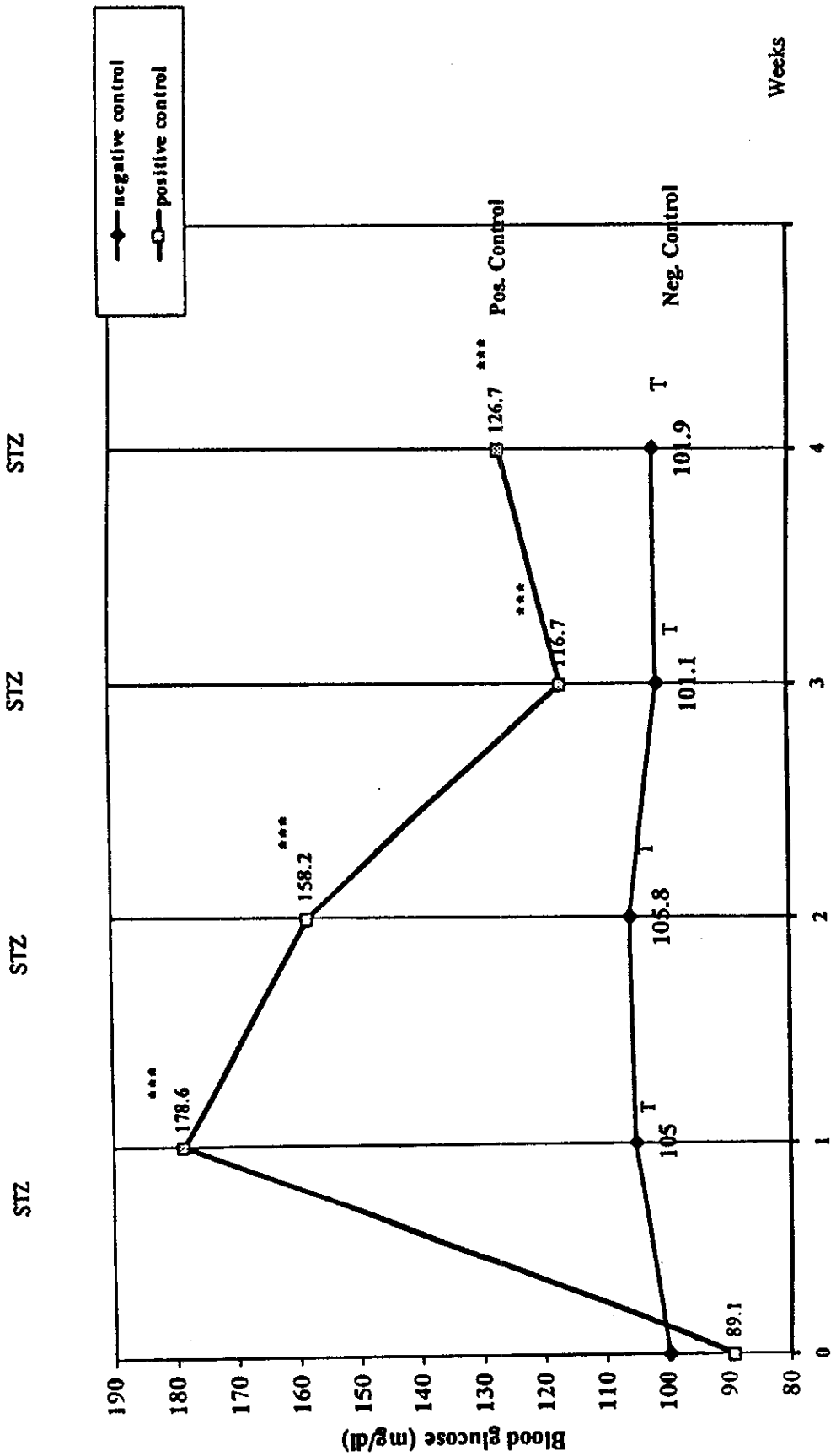
STZ (Booster dose 11.25 mg / kg b.w)

t : Insignificant difference from the corresponding control at $p < 0.05$

* : Significant difference from the corresponding control at $p < 0.02$

** : Highly Signficant difference from the corresponding control at $p < 0.001$

*** : Very highly Signficant difference from the corresponding control at $p > 0.01$



Fig(23): comparison between blood glucose levels of positive control and negative control rats

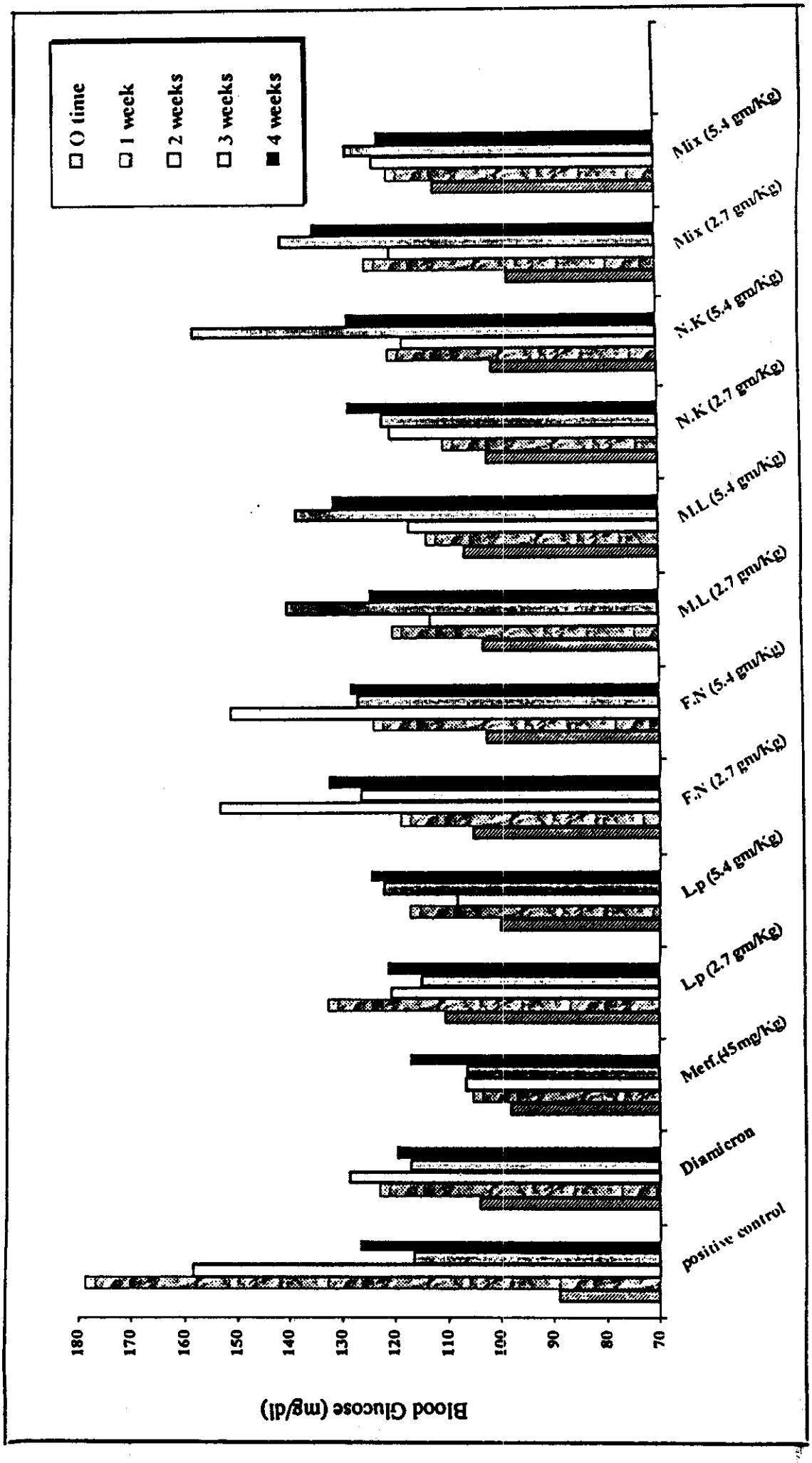


Fig (24): Blood glucose levels of positive control rats as compared with different treated animal groups

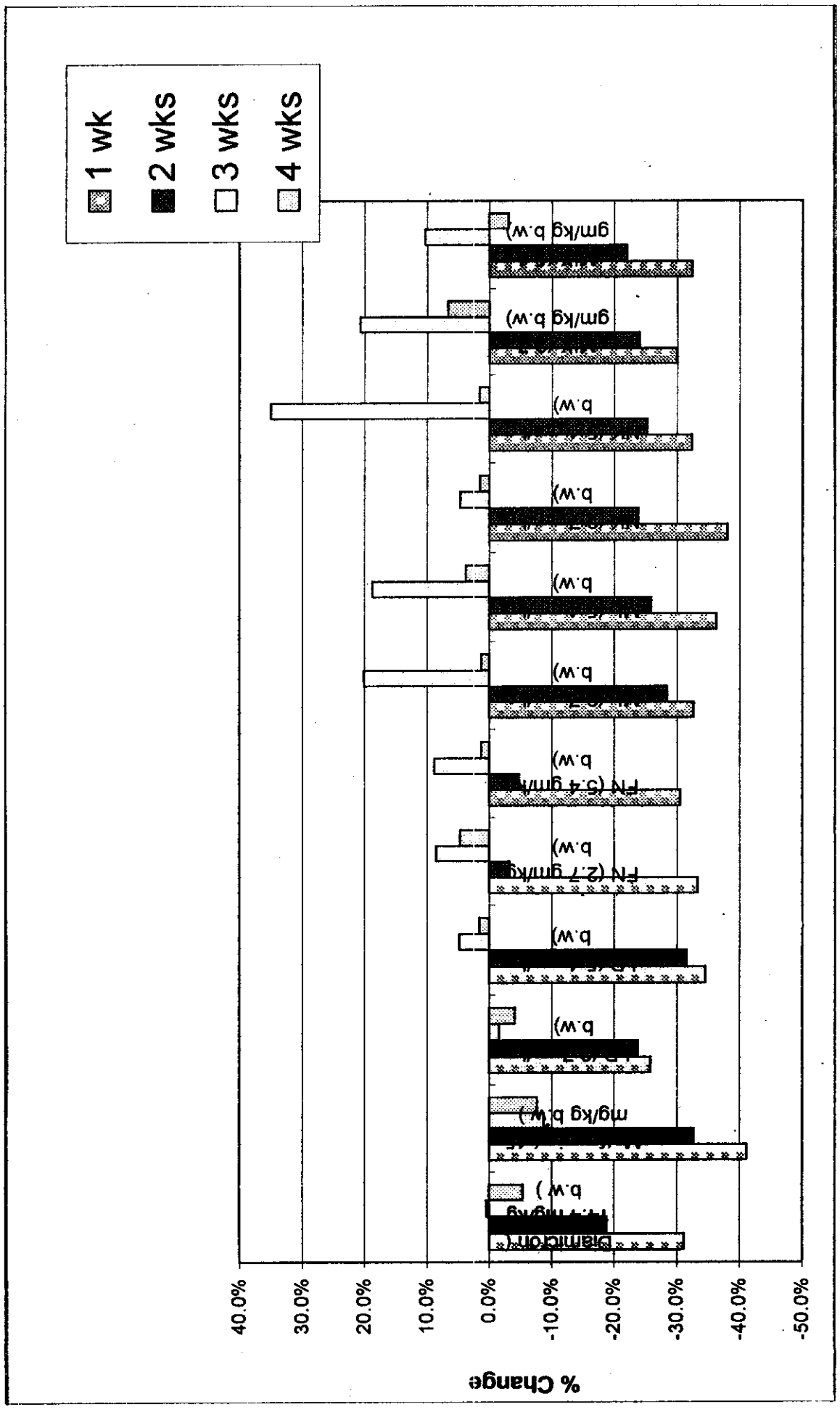


Fig (25) : Percent variation of blood glucose levels of different treated groups compared to positive animal group