RESULTS

Table (6): Patients' clinical data

			No.	%
Nutritional history	Exclusive breast feeding		4	13
	Bottle feeding	Raw milk	2	7
		Powder milk	6	20
		Fluids	2	7
		Powder milk + Fluids	2	7
	Both breast and bottle feeding		14	46
CLINICAL SIGNS				
Clinical presentation	Decreased weight +	Repeated GE	13	43
		Repeated chest infection	9	30
		Repeated GE & Chest infection	8	27
Type of PEM	Marasmus kwashiorkor		6	20
	Marasmus	Mild	17	57
		Moderate	7	23
Other clinical signs	Vitamin deficiencies	No	22	73.3
		Present	8	26.7

Table (6): shows the following data:

- All patients presented with decreased weight combined with repeated gastroenteritis, (GE) in 13 patients (43%), repeated chest infection in 9 patients (30%) and combined with both chest infection and gastroenteritis in 8 patients (27%) (Fig. 5).
- With regards to the nutritional history, 4 patients (13%) depended on breast feeding, 12 patients depended on bottle feeding, of those 2 patients (7%) fed raw milk, 6 patients (20%) fed powder milk, 2 patients (7%) fed only fluids, and 2 patients (7%) received both fluids and powder milk. There were 14 patients (46%) fed both breast and bottle feeding (Fig. 6).
- There were 6 patients (20%) with signs of marasmus-kwoashirkor and 24 patients with signs of marasmus, of those there were 17 patients (57%) with mild marasmus (Grade I) and 7 patients (23%) had moderate marasmus (Grade II).
- Signs of vitamin deficiencies were detected in 8 patients (73.3%) in the form of angular stomatitis.

Fig. (5): Classification of patients according to mode of presentation

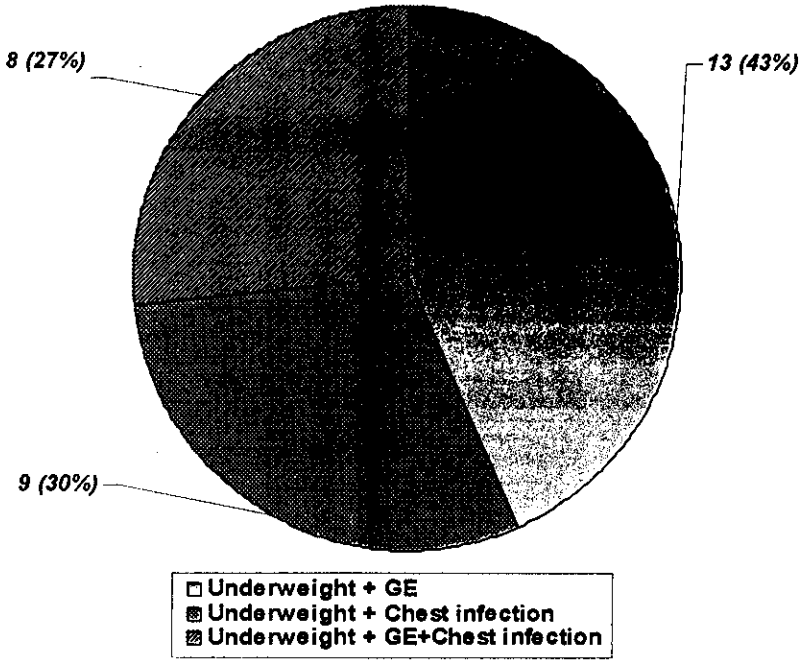


Fig. (6): Classification of patients according to the nutritional history

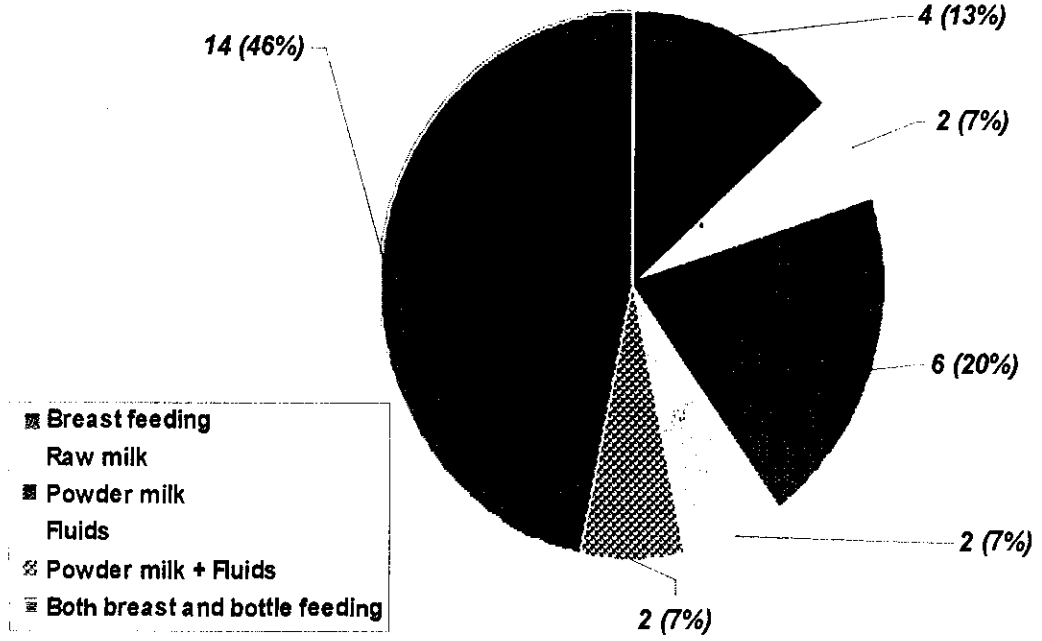


Table (7): Comparison of personal and anthropometric measurements of patients versus control group

Data \ Group	Patients group (n=30)	Control group (n=10)
Age (months)	9.7±3.7 (4-18)	9.9±4.3 (4-18)
Weight (Kg)	5.4±1.1* (3-7)	8.8±1.5 (6.5-11)
Height (cm)	74.1±5.1 (64-84)	75±5.4 (66-84)
Head circumference (cm)	45±1.9 (41-49)	46.1±1.4 (44-49)
Mid-arm circumference (cm)	10±0.8* (8-11)	11±0.7 (10-12)
Sex; M/F	12/18	4/6

Data are shown as Mean± SD, ranges in parenthesis.
**= significant difference versus the control group.*

Table (7): shows the personal data of children included in both the control and patients groups. There was a non-significant difference between both groups as regards the age, height and head circumference of the children included in both groups. However, there was a significant ($P<0.05$) decrease in the weight of patients (5.4±1.1, range; 3-7 Kg) compared with the age of control children (8.8±1.5, range; 6.5-11 Kg) (Fig. 7). Also, mid-arm circumference showed a significant ($P<0.05$) decrease in patients (10±0.8, range; 8-11 cm) compared to the control children (11±0.7, range; 10-12 cm) (Fig. 8).

Fig. (7): The mean weight of PEM patients versus control group

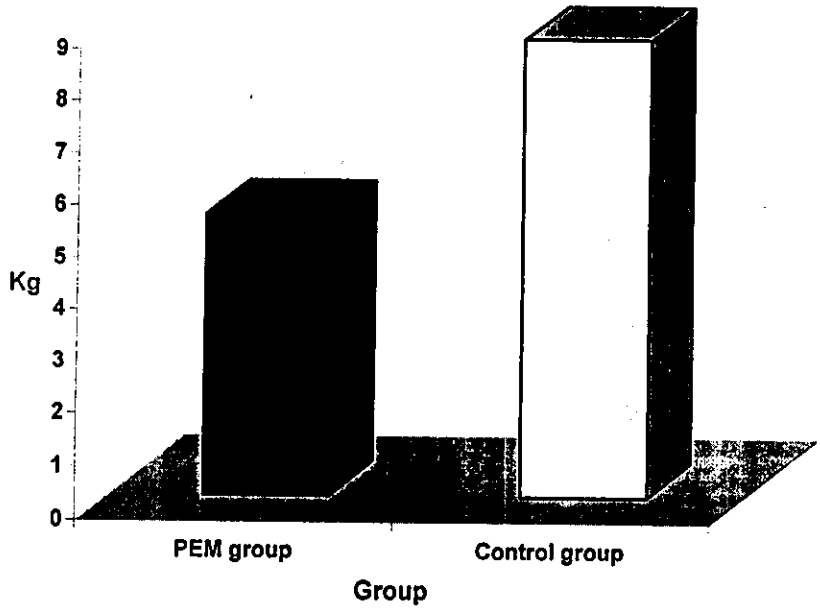


Fig. (8): The mean mid-arm circumference of PEM patients versus control group

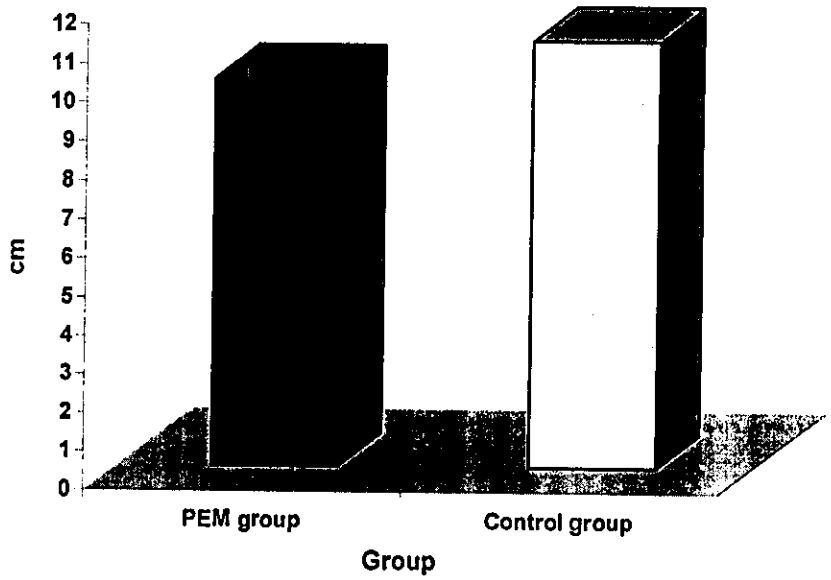


Table (8): The expected percentile values of weight, height and head circumference of male PEM patients (n=12) relative to their age and percentage of difference

Group / Data	Expected percentile value	Patients' values	% of difference
Weight (Kg)	9.82±1.15 (7-11.1)	5.4±0.9* (3.5-6.5)	45.3±7.3 (59.1) - (36.6)
Height (cm)	77.3±4.1 (68-83.5)	74.8±3.9 (66-81)	3.3±0.9 (4.88) - (2)
HC (cm)	47.2±1.6 (44-49.25)	44.7±1.9* (41-47)	5.36±1.17 (7.7) - (4.2)

Data are shown as Mean+SD, ranges in parenthesis.
** = significant difference versus the control group.*

Table (8): shows the expected percentile values of weight, height and head circumference of male patients relative to their age and percentage of difference. There was a significant ($P<0.05$) decrease of patients' weight (5.4±0.9; range, 3.5-6.5 Kg) compared to the expected 75th percentile value of weight in relation to similar age (9.82±1.15; range 7-11.1 Kg), with a mean percentage of decrease of 45.3±7.3%; range 36.6-59.1% (Fig. 9). Similarly, head circumference showed a significant ($P<0.05$) decrease in patients (44.7±1.9;range41-47cm) compared to the mean expected 90th percentile of HC in relation to the corresponding age, (47.2±1.6; range 44-49.25 cm), with a mean percentage of decrease of 5.36±1.17%; range 4.2-7.7% (Fig. 10). On the other hand, there was a non-significant decrease in patients' length (74.8±3.9; range 66-81 cm) compared to the expected 90th percentile of height for age (77.3±4.1; 68-83.5 cm), with a mean percentage of decrease of 3.3±0.9%; range 2-4.88% (Fig. 11).

Fig. (9): Actual weight, the 75th percentile of weight for age and the percentage of decrease in male PEM patients

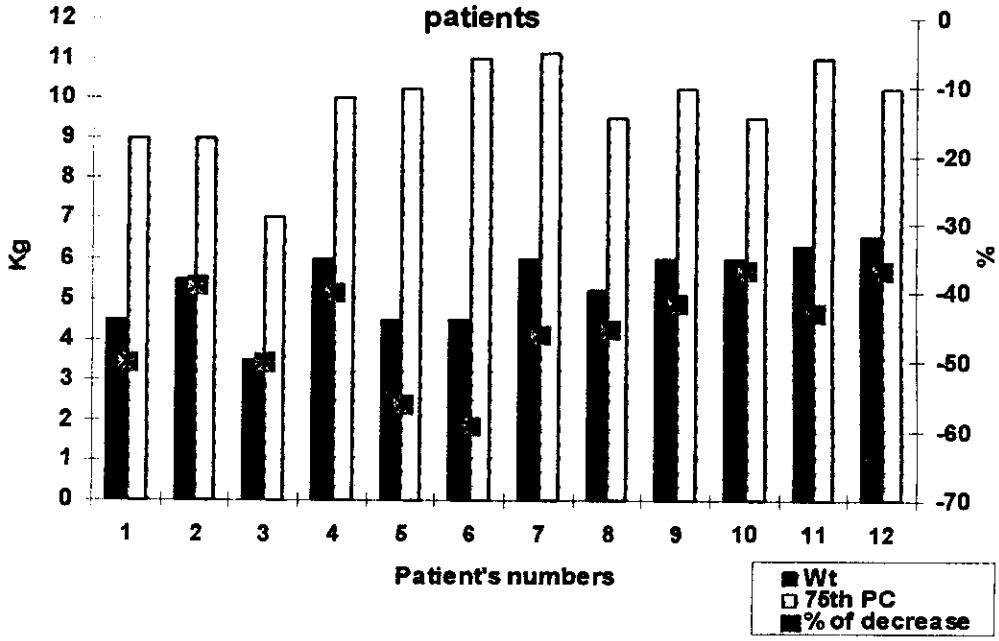


Fig. (10): Actual HC, the 90th percentile of HC for age and the percentage of decrease in male PFM

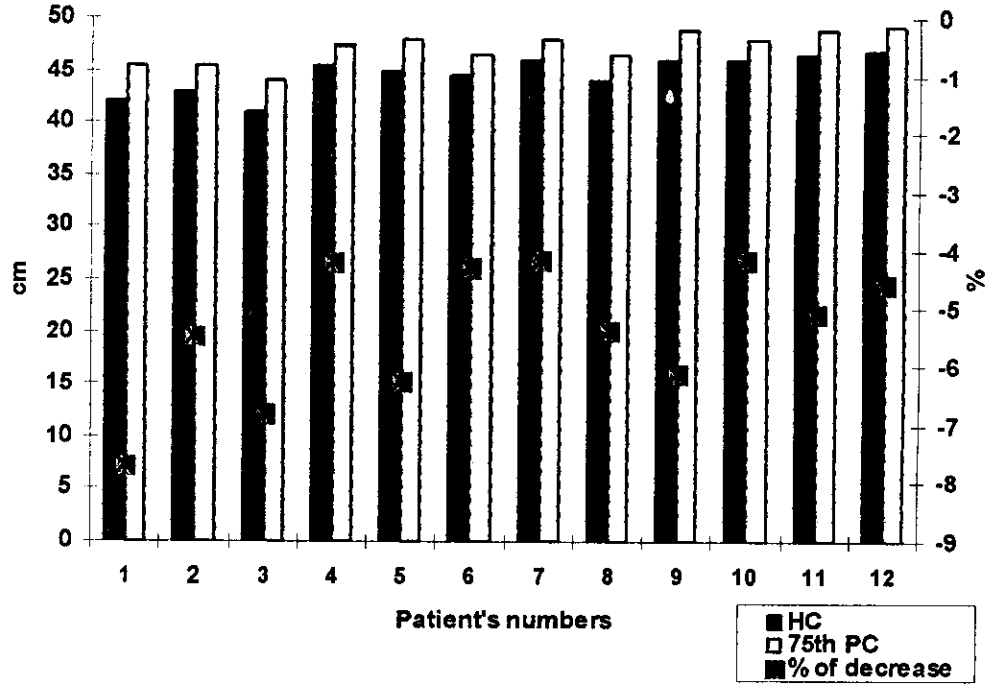


Table (9): The expected percentile values of weight, height and head circumference of female PEM patients (n=18) relative to their age and percentage of difference

Group / Data	Expected percentile value	Patients' values	% of difference
Weight (Kg)	9.7±1.45 (6.75-12)	5.37±1.16 (3-7)	45±7.5 (61.3) - (33.3)
Height (cm)	76.4±6.2 (66-87)	73.8±5.8 (64-84)	3.3±0.8 (5) - (2)
HC (cm)	47.5±2 (43-50)	45.3±1.9 (42-49)	4.66±1.68 (7.9) - (2)

Data are shown as Mean±SD, ranges in parenthesis.
** = significant difference versus the control group.*

Table (9): shows the expected percentile values of weight, height and head circumference of female patients relative to their age and percentage of difference. There was a significant ($P<0.05$) decrease of patients' weight (5.37±1.16; range, 3-7 Kg) compared to the expected 75th percentile value of weight in relation to similar age (9.7±1.45; range 6.75-12 Kg), with a mean percentage of decrease of 45±7.5%; range 33.3-61.3% (Fig. 12). Similarly, head circumference showed a significant ($P<0.05$) decrease in patients (45.3±1.9; range 42-49 cm) compared to the mean expected 90th percentile of HC in relation to the corresponding age, (47.5±2; range 43-50 cm), with a mean percentage of decrease of 4.66±1.68%; range 2-7.9% (Fig. 13). On the other hand, there was a non-significant decrease in the patients' length (73.8±5.8; range 64-84 cm) compared to the expected 90th percentile of height for age (76.4±6.2; 66-87 cm), with a mean percentage of decrease of 3.3±0.8%; range 2-5% (Fig. 14).

Fig. (11): Actual height, the 90th percentile of height for age and the percentage of decrease in male PEM patients

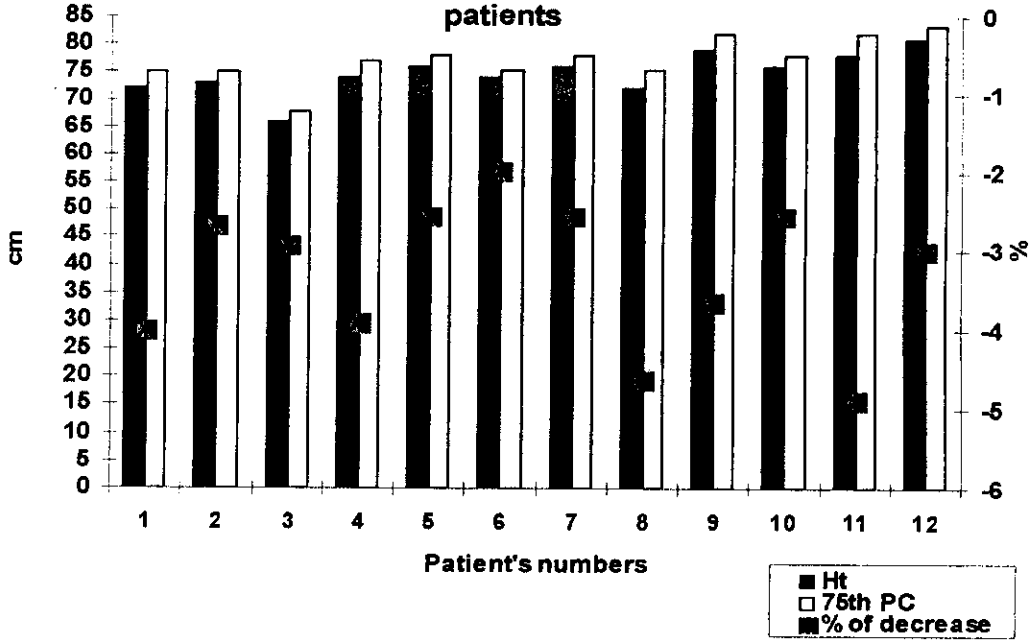


Fig. (12): Actual weight, the 75th percentile of weight for age and the percentage of decrease in female PEM patients

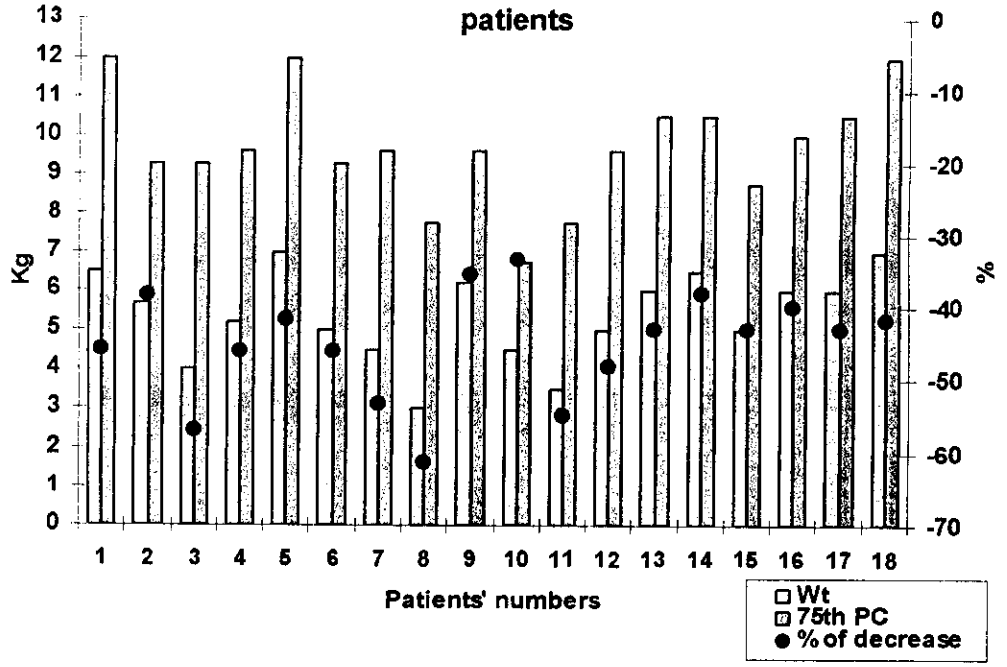


Fig. (13): Actual HC, the 90th percentile of HC for age and the percentage of decrease in female PEM patients

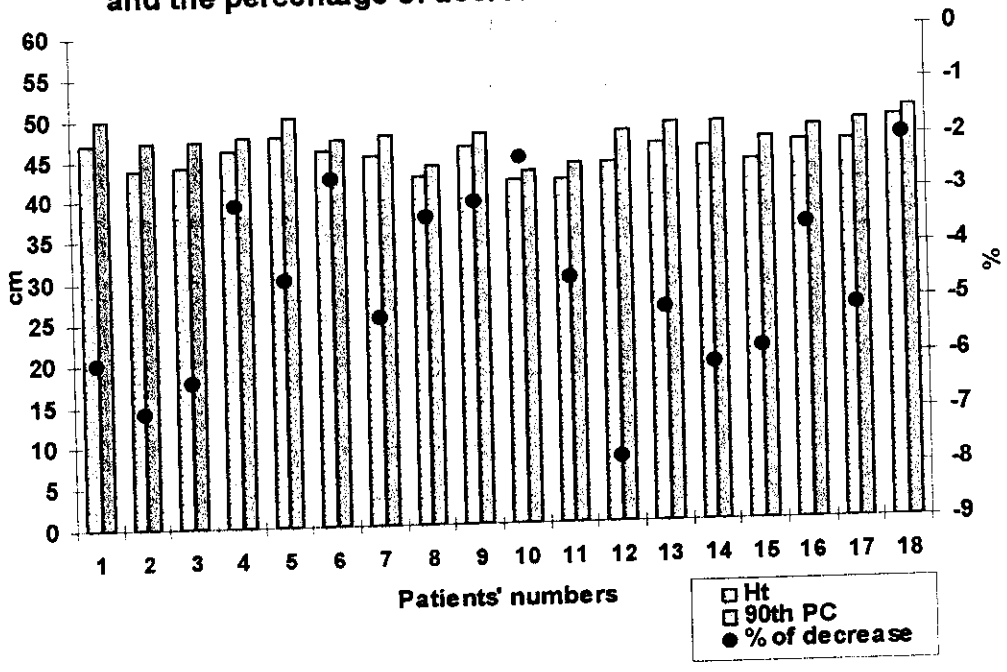


Fig. (14): Actual height, the 90th percentile of height for age and the percentage of decrease in female PEM patients

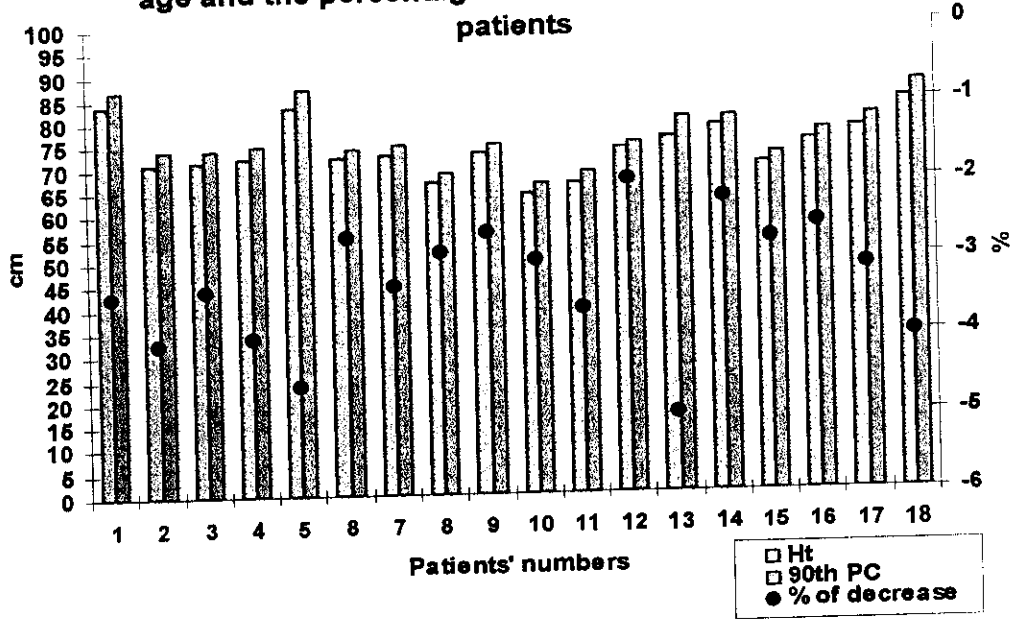


Table (10): Laboratory findings in control children and PEM patients (prior to treatment)

Data \ Group	PEM group (n=30)	Control group (n=10)	P value
Serum total protein (gm/dl)	5.92±0.42* (5.2-6.5)	7.1±0.7 (5.93-8.02)	<0.001
Serum albumin (gm/dl)	3.27±0.6* (1.83-4.1)	4.32±0.52 (3.62-5.1)	<0.001
Serum alkaline phosphatase (U/L)	470±71* (341-544)	413±50 (349-502)	<0.01
Serum triglycerides (mg/dl)	150.4±68.2* (58-384)	108.5±48.8 (60-202)	<0.025
Serum total cholesterol (mg/dl)	105.5±45.3 (15-247)	92±49.5 (32-203)	>0.05
Fasting blood glucose (mg/dl)	54 ±9.9* (40-65)	78±9.1 (67-99)	<0.001

Data are shown as Mean±SD, ranges in parenthesis.
**= significant difference versus the control group.*

Table (10): shows comparison of biochemical changes of PEM patients versus the control group. Patients showed a significant (P<0.001) decrease of serum total proteins (5.92±0.42, range; 5.2-6.5 gm/dl) compared to the controls (7.1±0.7, range; 5.93-8.02 gm/dl), also showed a significant (P<0.001) decrease of serum albumin (3.27±0.6, range; 1.83-4.1 gm/dl) in patients compared to the control group (4.32±0.52, range; 3.62-5.1 gm/dl) (Fig. 15). Moreover, there was a significant (P<0.001) decrease of fasting blood glucose level (54 ±9.9, range; 40-65 mg/dl) in patients compared to the control group (78±9.1, range; 67-99 mg/dl). On the other hand, there was a significant (P<0.01) increase of serum alkaline phosphatase in patients (470±71, range; 341-544 U/L) compared to control group (413±50, range; 349-502 U/L) (Fig. 16); also, there was significant (P<0.025) increase of serum triglycerides in patients (150.4±68.2, range; 58-384 mg/dl) compared to the control group (108.5±48.8, range; 60-202 mg/dl) (Fig. 17). However, serum total cholesterol showed a non-significant difference between both groups.

Fig. (15): serum level of total proteins and albumin in PEM patients versus the control group

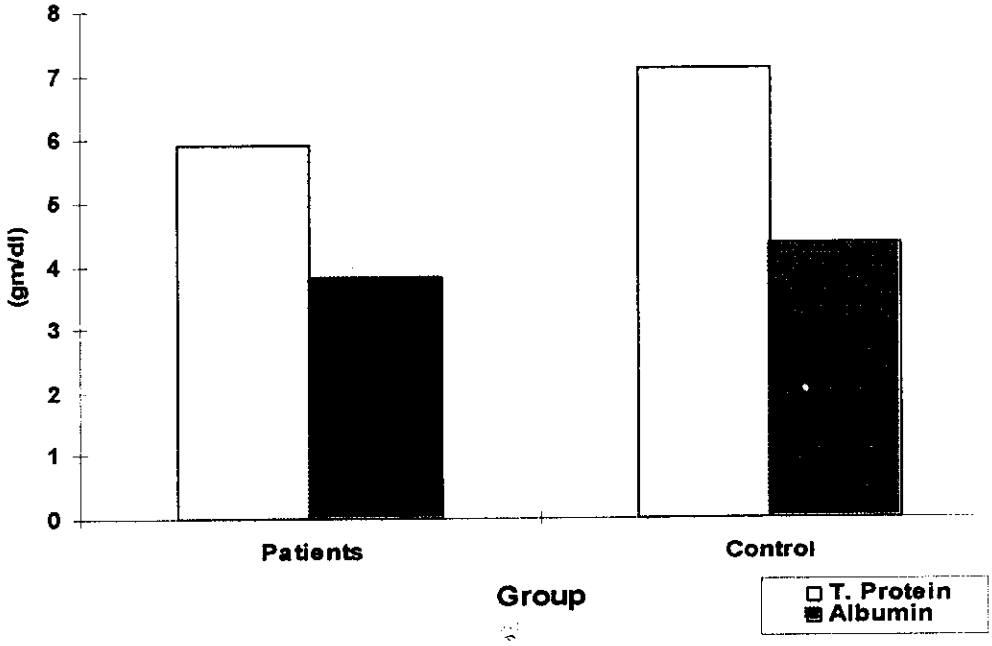


Fig. (16): Serum alkaline phosphatase in PEM patients versus the control group

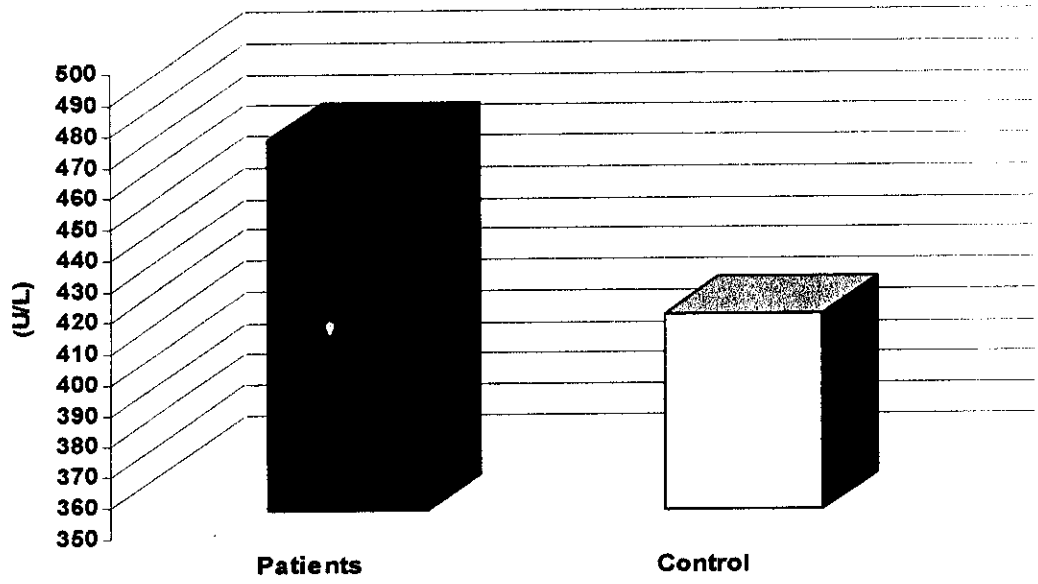


Table (11): Comparison of serum level of different types of PEM patients (prior to treatment) versus the control group

Data \ Group		Patients group (n=30)	Control group (n=10)	P value
Serum total protein (gm/dl)		5.92±0.42* (5.2-6.5)	7.1±0.7 (5.93-8.02)	<0.001
Serum albumin (gm/dl)		3.27±0.6* (1.83-4.1)	4.32±0.52 (3.62-5.1)	<0.001
Serum globulins (gm/dl)	α_1	0.455±0.2 (0.2-0.98)	0.31±0.19 (0.12-0.55)	>0.05
	α_2	0.6±0.3 (0.19-1.63)	0.47±0.2 (0.19-0.75)	>0.05
	β	0.7±0.2* (0.35-1)	0.863±0.21 (0.46-1.08)	<0.05
	γ	0.736±0.17* (0.41-1)	1.075±0.37 (0.55-1.57)	<0.01
	Total	2.57±0.63 (1.67-4.1)	2.72±0.8 (1.44-3.76)	>0.05
Albumin/globulins		1.37±0.48 (0.46-2.49)	1.8±0.82 (1.08-3.41)	>0.05

Data are shown as Mean±SD, ranges in parenthesis.
**= significant difference versus the control group.*

Table (11): shows a significant (P<0.05) decrease of serum total proteins (5.92±0.42, range; 5.2-6.5 gm/dl) in PEM group compared to the control children (7.1±0.7, range; 5.93-8.02 gm/dl), also patients showed a significant (P<0.05) decrease of serum albumin (3.27±0.6, range; 1.83-4.1 gm/dl) compared to its level in control group (4.32±0.52, range; 3.62-5.1 gm/dl) (Fig. 18). On the other hand, there were non-significant differences between both groups as regards serum levels of total and both α_1 and α_2 globulins.However there was a significant (P<0.05) decrease of serum level of β globulins in patients (0.7 ±0.2 range; 0.35-1 mg/dl) compared to control group (0.863±0.21, range; 0.46-1.08), also γ globulins were significantly (P<0.01) decreased in patients (0.736±0.17, range; 0.41-1 mg/dl) versus control group (1.075±0.37, range; 0.55-1.57 mg/dl) (Fig. 19). The A/G ratio showed a non-significant decrease in patients compared to the control group.

Fig. (17): Serum levels of triglycerides and fasting blood glucose in PEM patients versus control group

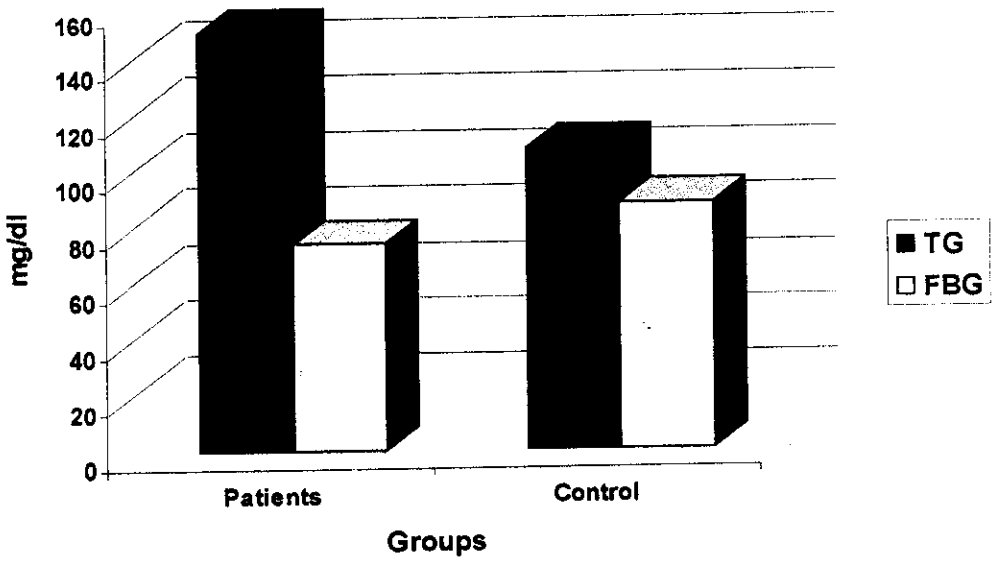


Fig. (18): Serum globulins in PEM patients versus the control group

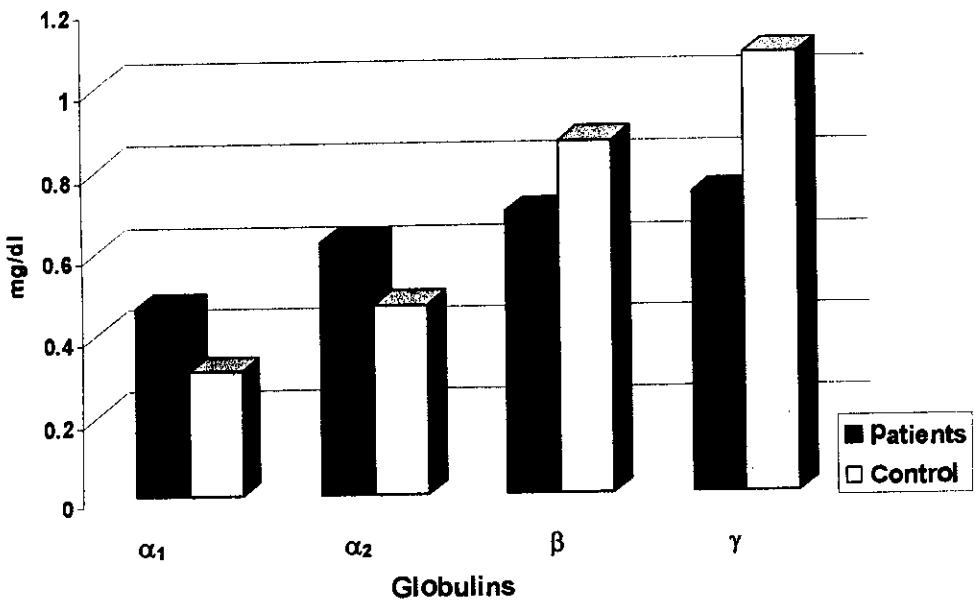


Table (12): Estimated CBC in control children and patients (prior to treatment)

Group / Data	PEM group (n=30)	Control group (n=10)	P value
Hb conc. (gm/dl)	8.14±0.5* (7-8.9)	12.2±0.2 (11.9-12.5)	<0.001
RBCs (10^6 cells/μl)	3.35±0.32* (2.9-4)	4.18±0.09 (4-4.3)	<0.001
Platelet count (10^3 platelet/μl)	177.5±16.3 (150-210)	174.6±6.9 (163-184)	>0.05
TLC (10^3 cell/μl)	11.3±0.4* (4.6-18.9)	7.8±0.59 (6.7-8.6)	<0.001

Data are shown as Mean±SD, ranges in parenthesis.
** = significant difference versus the control group.*

Table (12): shows estimated CBC of both patients and controls. Patients showed a significant (P<0.001) decrease of hemoglobin concentration (8.14±0.5, range; 7-8.9 gm/dl) compared to the control children (12.2±0.2, range; 11.9-12.5 gm/dl), also showed a significant (P<0.001) decrease of RBCs count (3.35±0.32, range; 2.9-4 x10^6 cell/dl) compared to its level in control group (4.18±0.09, range; 4-4.3 x10^6 cell/dl). Moreover, there was a significant (P<0.001) increase of total leucocytic count in patients' group (11.3±0.4, range; 4.6-18.9 x10^3 cell/dl) compared to the control group (7.8±0.59, range; 6.7-8.6 x10^3 cell/dl) (Fig. 20). On the other hand, there were non-significant differences between both groups as regards the platelet count.

Fig. (19): The mean RBCs and TLC in PEM patients versus the control group

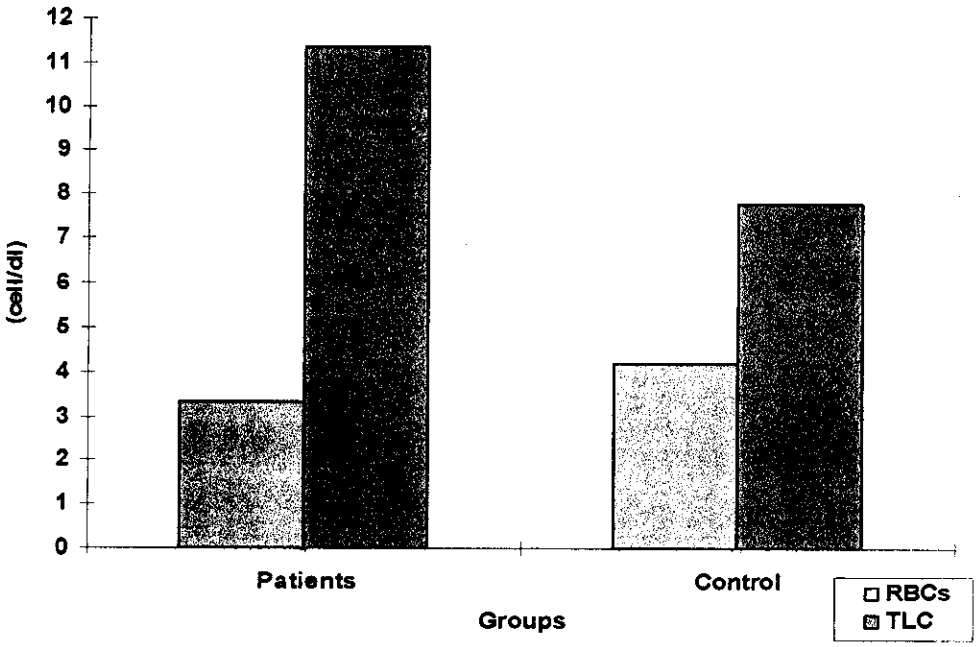


Fig. (20): Clinical signs detected in PEM patients on admission and 4-wks after treatment

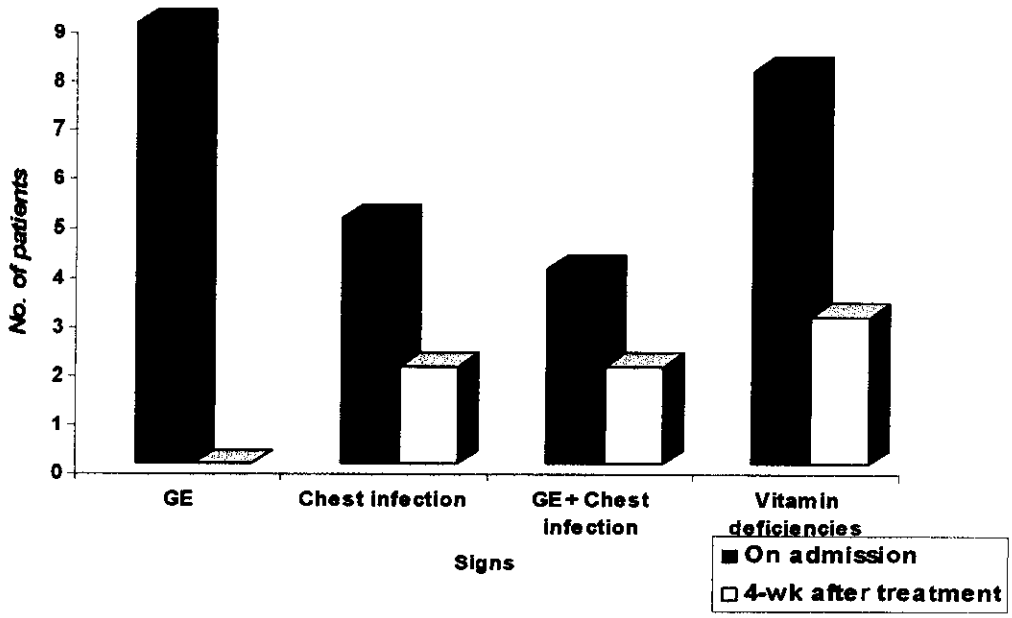


Table (13): **Four-weeks after treatment clinical data of PEM patients admitted to the in-patient wards (n= 18) compared to their pretreatment data**

Clinical signs	On admission		4 weeks after treatment	
	No.	%	No.	%
GE	9	50	0	0
Chest infection	5	27.8	2	11.1
GE + Chest infection	4	22.2	2	11.1
Vitamin deficiencies	8	44.4	3	16.7

Table (13): shows the effect of treatment on some clinical signs reported in PEM patients admitted to the in-patient wards. There was a significant (X^2= 8.8, P<0.01) improvement in their clinical status with significant disappearance of vitamin deficiencies. No patient had gastroenteritis except 2 in whom gastroenteritis was secondary to viral chest infection. Also, 2 patients had chest infection, but not accompanied by gastroenteritis. Signs of vitamin deficiencies were reported only in 6 of the 15 patients whom had previous signs (Fig. 21).

Table (14): Mean (±SD) weight changes occurred, four-weeks after treatment, in PEM patients according to type and degree of PEM compared to their pre-treatment weight

		PEM group		Control group (n=10)
		On admission	4-weeks after treatment	
Total PEM patients		5±1.1† (3-7)	7.1±0.9†‡ (5.1-8.5)	8.8±1.5 (6.5-11)
M-Kwashiorkor (n=6)		6.1±0.6† (5.2-7)	8±0.3†‡ (7.5-8.5)	
Marasmus	Mild (n=9)	4.7±0.5† (4-5.5)	7±0.4†‡ (6.2-7.5)	
	Moderate (n=3)	3.3±0.3† (3-3.5)	5.7±0.5†‡ (5.1-6.1)	

Data are shown as Mean±SD, ranges in parenthesis.
†= *significant difference versus the control group.*
‡= *significant difference versus pre-treatment.*

Table (14): shows the effect of treatment on weight of PEM patients admitted to the in-patient wards. There was remarkable weight gain with significant ($P<0.001$) increase of post-treatment weight compared to the pre-treatment weight, but still there was a significant decrease in comparison to the control group. Patients who had marasmus-kwashiorkor had the best improvement with a significant difference in comparison to the other PEM patients. Patients with moderate marasmus showed the least improvement (Fig. 21).

Table (15): Comparison of some laboratory findings of PEM patients (prior to treatment) and after recovery versus the control group

Parameter		PEM group (n=18)		Control group (n=10)
		On admission	4-weeks after treatment	
Hb conc. (gm/dl)		8.24±0.57† (7-8.9)	9±0.8†‡ (7.2-10.1)	12.2±0.2 (11.9-12.5)
S. Proteins (gm/dl)	Total	5.8±0.4† (5.3-6.5)	6.45±0.6†‡ (5.3-7.3)	7.1±0.7 (5.93-8.02)
	Albumin	3.3±0.55† (2-4.1)	4.19±0.4‡ (3.7-5.5)	4.32±0.52 (3.62-5.1)
	T. globulins	2.47±0.61 (1.71-4.32)	2.25±0.63 (0.89-3.07)	2.72±0.8 (1.44-3.76)
	β-globulins	0.66±0.21† (0.35-1)	0.723±0.22† (0.27-0.97)	0.863±0.21 (0.46-1.08)
	γ-globulins	0.7±0.2† (0.4-0.9)	0.89±0.2‡ (0.46-1.19)	1.075±0.37 (0.55-1.57)
Serum alkaline phosphatase. (U/L)		475.8±67.3† (341-543.7)	422.7±75.6‡ (301-543.7)	413.1±49.9 (348.5-502)
S. triglycerides (mg/dl)		160.8±67.4† (108-384)	120±29‡ (64-213)	109±48.8 (60-202)
S. total cholest (mg/dl)		104.7±45 (47-198)	95.4±25.5 (48-122)	92±49.5 (15-203)
Fasting blood glucose (mg/dl)		54±9.9 (40-65)	72.3±9.6‡ (62-97)	78±9.1 (67-99)

Data are shown as Mean±SD, ranges in parenthesis.
† = significant difference versus the control group.
‡ = significant difference versus pre-treatment.

Table (15): shows the effect of treatment on some laboratory parameters, patients showed a significant (P<0.05) increase of hemoglobin concentration (9±0.9, range; 7.2-10.1 gm/dl) after treatment compared their concentration prior to treatment, despite the still significant (P<0.05) decrease versus the control children (Fig. 22). Also, serum total proteins showed a significant (P<0.05) increase (6.45±0.6, range; 5.3-7.3 mg/dl) after treatment compared to their levels prior to treatment, but the difference still significant (P<0.05) compared to the control group. Similarly, serum albumin showed a significant (P<0.05) increase (4.19±0.4, range; 3.7-5.5 mg/dl) after treatment compared to

its level in prior to treatment, moreover, serum albumin showed a non-significant (P>0.05) decrease versus the control level. Moreover, serum levels of γ-globulins showed significant (P<0.05) increase (0.89±0.2; range, 0.46-1.19 gm/dl) in comparison to the pretreatment level and non-significant decrease in comparison to control levels (Fig. 23). Furthermore, serum alkaline phosphatase (422.7±75.6; range 301-543.7 U/L) (Fig. 24) and triglycerides (120±29; range 64-213 mg/dl) (Fig. 25) showed a significant decrease after treatment compared to the pretreatment levels with a non-significant difference compared to control level. On the other hand, fasting blood glucose levels (72.3±9.6; range 62-97 mg/dl) showed a significant (P<0.05) increase compared to pre-treatment and a non-significant (P>0.05) decrease compared to control levels (Fig. 26).

Fig. (21): Weight of PEM patients (On admission & 4-wks after treatment) according to type and degree of PEM compared versus the control group

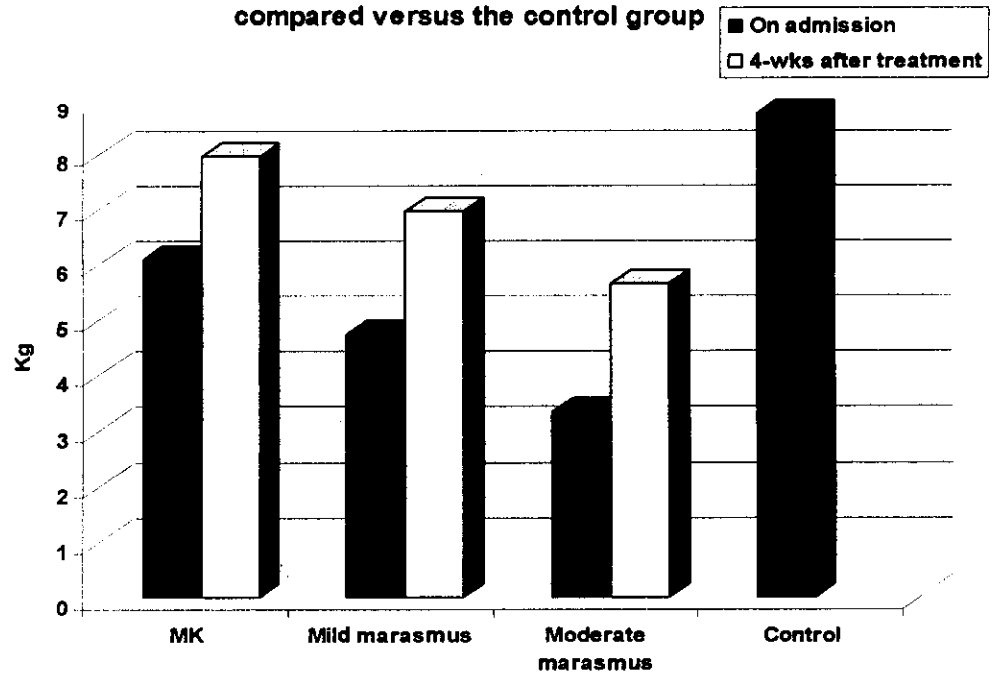


Fig. (22): Hemoglobin concnetration (gm/dl) in PEM patients (On admission & 4-wk after treatment) compared versus the control group

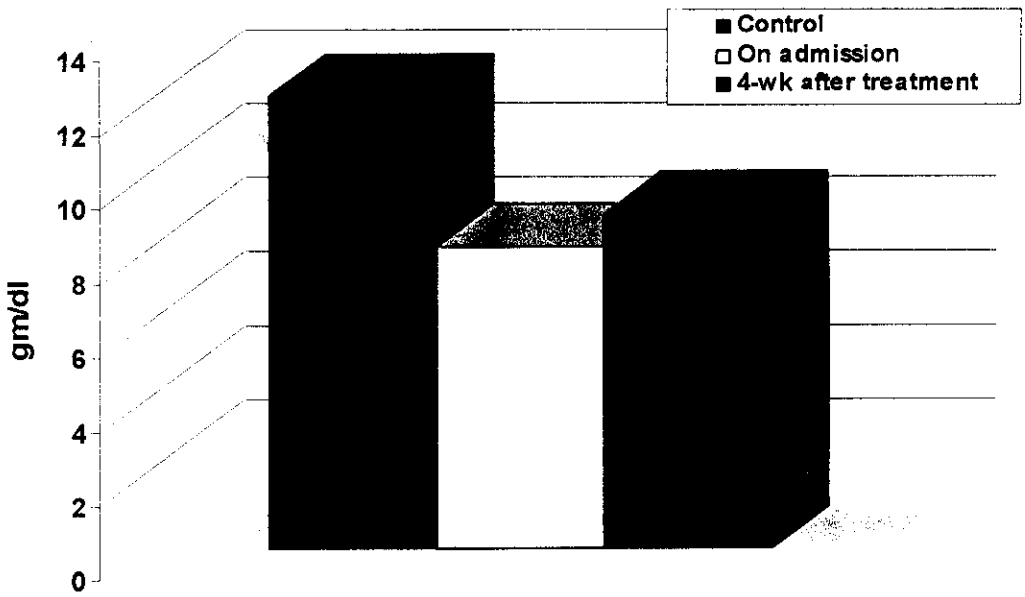


Fig. (23): serum total proteins, albumin & γ-globulins in PEM patients (On admission & 4-wk after treatment) compared to control group

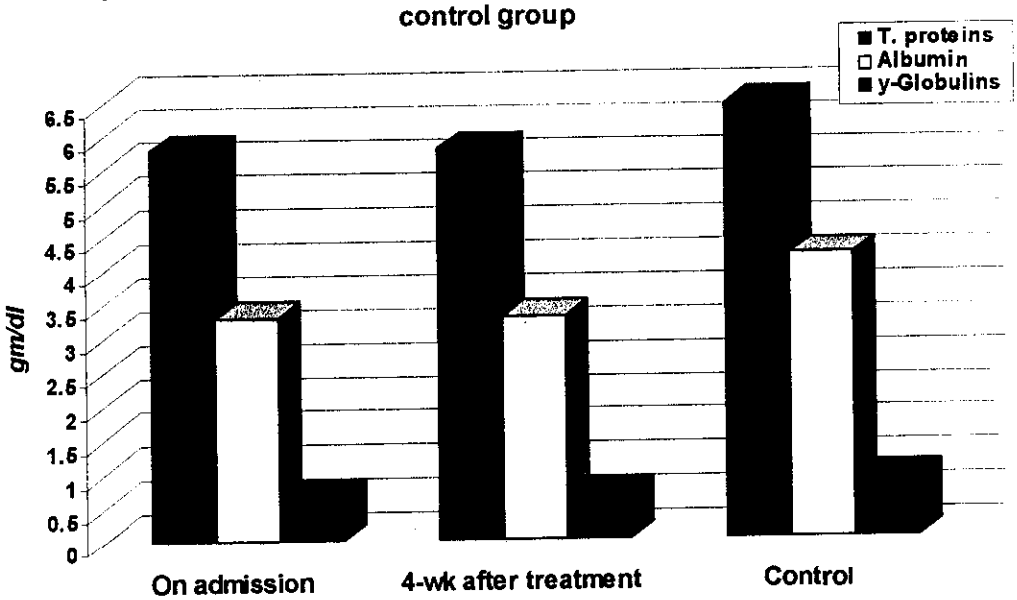


Fig. (24): Serum alkaline phosphatase levels in PEM patients (pre- & post-treatment) compared versus the control group

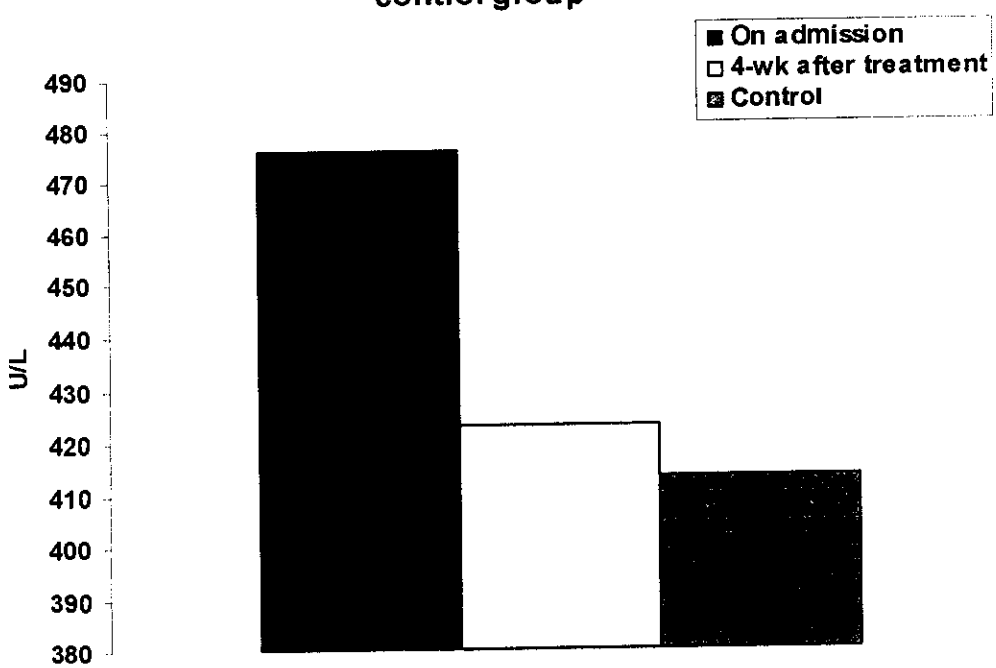
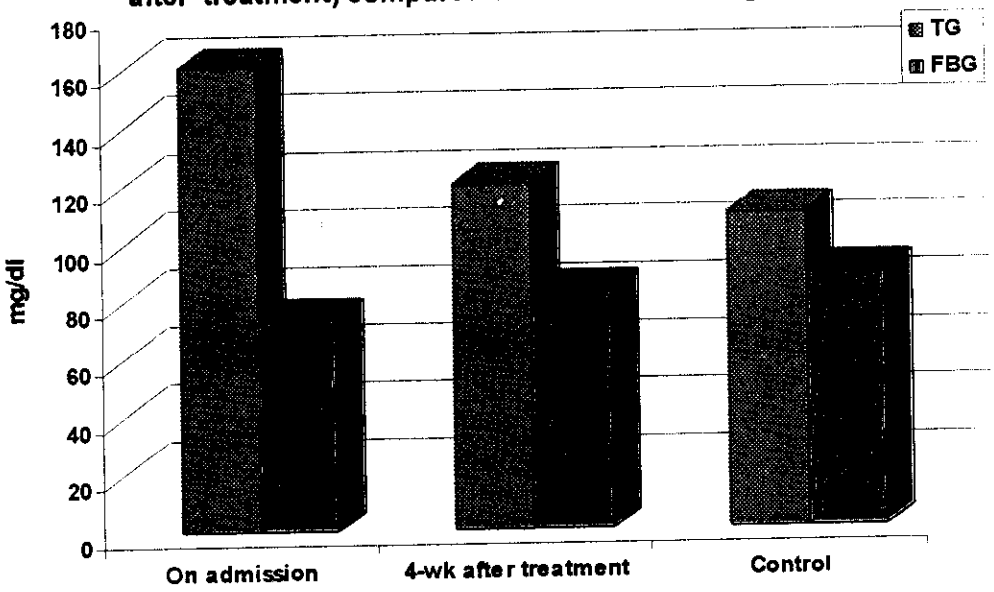


Table (16): Correlation coefficient between pre-treatment weight of PEM patients (n = 30) and some laboratory parameters

Parameters	Weight (Kg)	
	"r"	P
Hemoglobin concentration (gm/dl)	0.59	0.01
Serum total protein (gm/dl)	0.592	0.01
Serum albumin (gm/dl)	0.712	0.001
Serum γ-globulins (gm/dl)	-0.742	<0.001
Serum alkaline phosphatase (mg/dl)	-0.551	0.018
Serum triglycerides (mg/dl)	-0.484	0.042
Fasting blood glucose (mg/dl)	0.664	0.003

Table (16) shows the correlation coefficients between pretreatment weight of PEM patients and some laboratory parameters. There was a positive significant correlation between pretreatment weight and hemoglobin concentration (r=0.59, P=0.01) (Fig. 26), serum total proteins (r=0.592, P=0.01) (Fig. 27), serum albumin (r=0.712, P=0.001) (Fig. 28) and fasting blood glucose (r=0.664, P=0.003) (Fig. 29). Also, there was a negative significant correlation between pretreatment weight and serum γ -globulins (r=-0.742, P<0.001) (Fig. 30), serum alkaline phosphatase (r=-0.551, P=0.018) (Fig. 31), and serum triglycerides (r=- 0.484, P=0.042) (Fig. 32).

Fig. (25): Fasting serum triglycerides and blood glucose levels in PEM patients (On admission & 4-wk after treatment) compared versus the control group



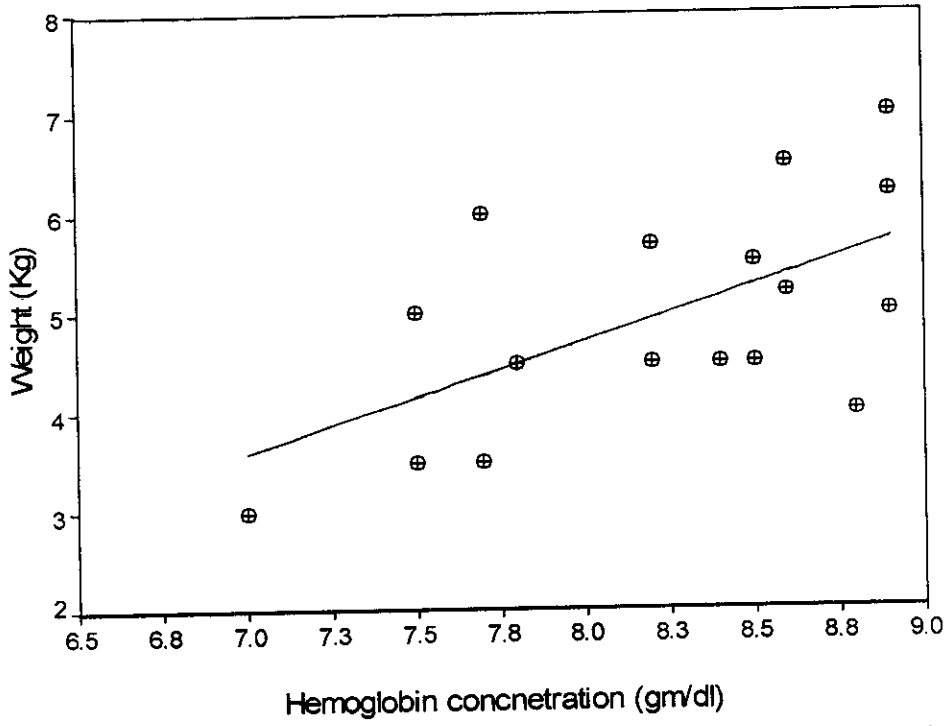


Fig (26): Correlation between pretreatment weight of PEM patients and hemoglobin concentration.

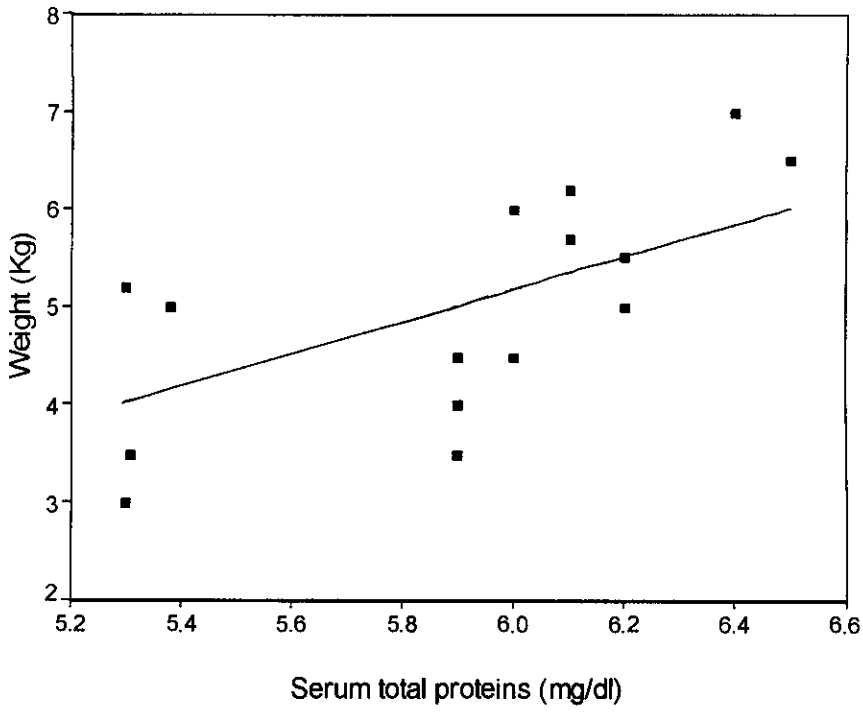


Fig (27): Correlation between weight of PEM patients and serum total proteins, on admission.

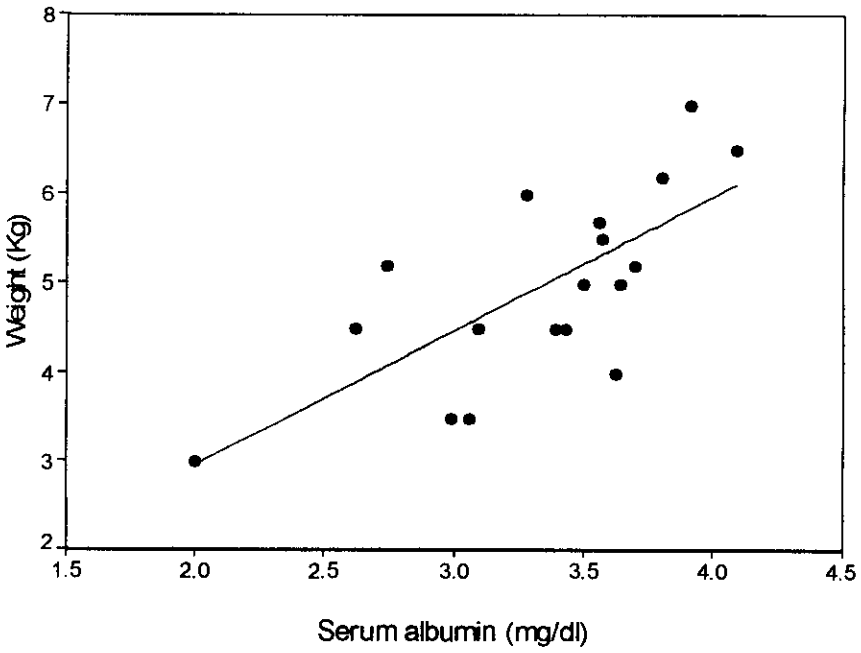


Fig (28): Correlation between weight of PEM patients and serum albumin, on admission.

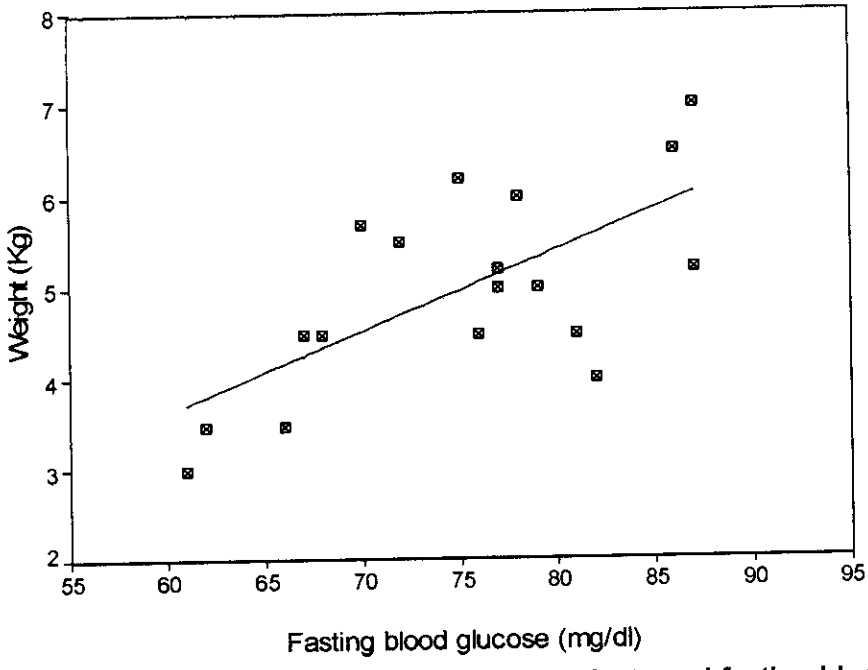


Fig (29): Correlation between weight of PEM patients and fasting blood glucose, on admission.

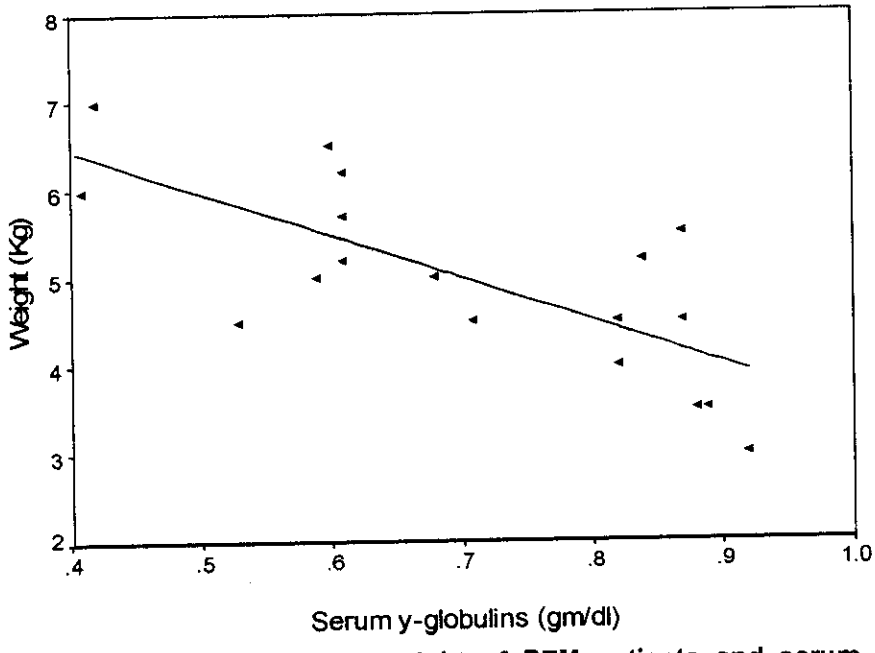


Fig (30): Correlation between weight of PEM patients and serum γ-globulins on admission.

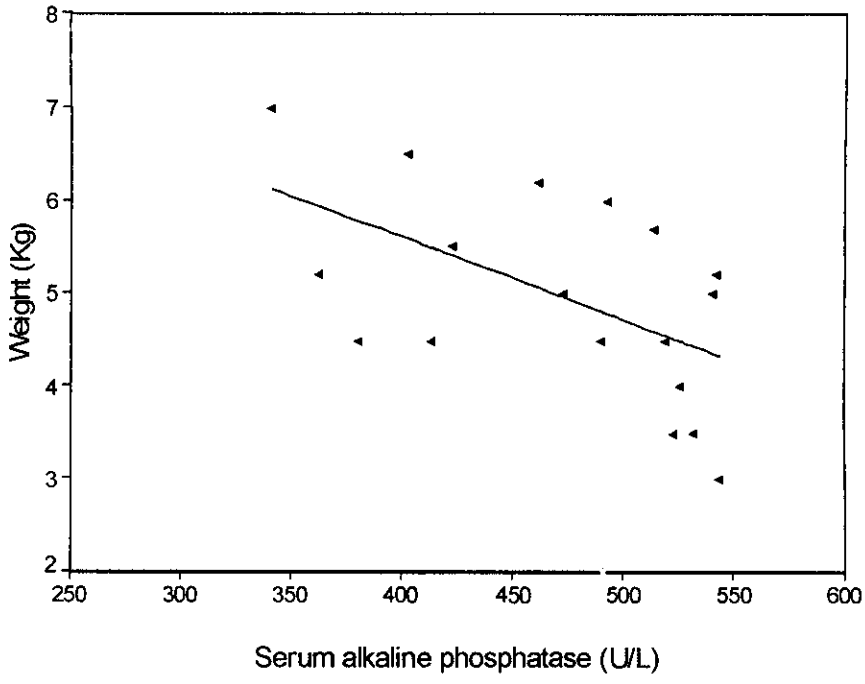


Fig (31): Correlation between weight of PEM patients and serum alkaline phosphatase, on admission.

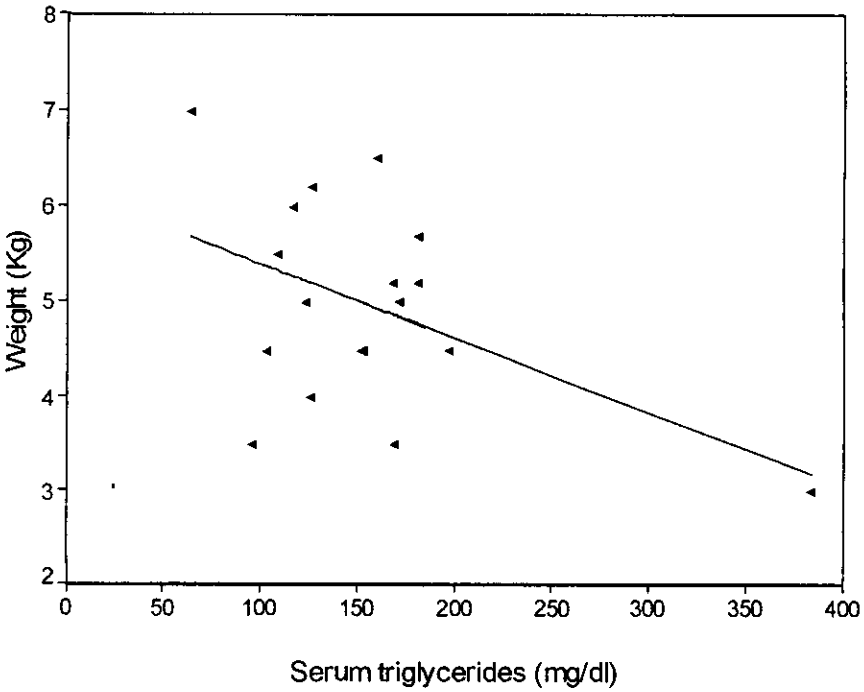


Fig (32): Correlation between weight of PEM patients and serum triglycerides, on admission.

Table (17): Backward-regression analysis of the estimated laboratory parameters in relation to pretreatment weight of PEM patients for the most diagnostic parameters

	Model 1		Model 2a		Model 3b		Model 4c		Model 5d		Model 6e		Model 7e	
	β	P	β	P	β	P	β	P	β	P	β	P	β	P
Alk. Phosph.	-0.51	0.022	-0.542	0.003	-0.514	0.001	-0.464	0.001	-0.47	0.000	-0.432	0.001	-0.432	0.001
Albumin	0.49	0.078	0.533	0.014	0.496	0.01	0.487	0.009	0.517	0.002	0.414	0.004	0.414	0.004
γ-Globulins	-0.518	0.006	-0.519	0.004	-0.509	0.003	-0.476	0.002	-0.463	0.002	-0.444	0.002	-0.444	0.002
Triglycerides	0.208	0.233	0.002	0.193	0.218	0.17	0.21	0.176	0.186	0.177				
Cholesterol	-0.206	0.426	-0.191	0.424	-0.2	0.384	-0.062	0.677						
Hb conc.	-0.202	0.451	-0.183	0.453	-0.19	0.42								
T. proteins	-0.053	0.775	-0.079	0.601										
FBG	0.053	0.793												

β: standardized coefficient

a- FBG was excluded.
b- FBG & T. proteins were excluded.
c- FBG, T. proteins & Hb conc. were excluded.
d- FBG, T. proteins, Hb conc. & cholesterol were excluded.
e- FBG, T. proteins, Hb conc., cholesterol & Triglycerides were excluded.

Table (17): shows the results of backward-regression analysis of the estimated laboratory parameters in relation to the pretreatment weight of PEM patients, using stepwise graduated exclusion of the least significant parameter, for defining the most diagnostic parameters for the severity of underweight. Using regression through 7 models, serum alkaline phosphatase showed the highest significant relation to weight reaching a summit at model-5, (β=-0.47, P=0.0001), and at models-6 & -7, (β=-0.432 respectively, P=0.001). Then, alkaline phosphatase was followed by serum γ-globulin levels reaching a summit at model-5, (β=-0.463, P=0.002), and at models-6 & -7, (β=-0.444 respectively, P=0.002). Followed by serum albumin, which reached a summit significance at model-5, (β=0.517, P=0.002), and at models-6 & -7, (β=-0.414 respectively, P=0.004). All other parameters were excluded.

Table (18): Comparison of some findings of PEM patients (on admission & 4-weeks after treatment) and after the percentage of change

Parameter	PEM group (n=18)		% of change
	On admission	4-weeks after treatment	
Weight (Kg)	5±1.1 (3-7)	7.1±0.9‡ (5.1-8.5)	46.3±19.8 (21.4-103.3)
Albumin (gm/dl)	3.3±0.55† (2-4.1)	4.19±0.4‡ (3.7-5.5)	28.3±21 (2.7-87)
γ-globulins (gm/dl)	0.7±0.2† (0.4-0.9)	0.89±0.2‡ (0.46-1.19)	32.7±46.9 ([-24.6]-162)
Serum alk. Ph. (U/L)	475.8±67.3† (341-543.7)	422.7±75.6‡ (301-543.7)	-16.6±29 ([-88]-20)

Data are shown as Mean+SD, ranges in parenthesis.
‡= significant difference versus pre-treatment.

Table (18): shows the effect of treatment on weight and some laboratory parameters, patients' weight was increased after treatment by 46.3±19.8%, with a range of increase of 21.4-103.3% of pretreatment weight. Serum albumin was increased by 28.3±21%; range 2.7-87% of pretreatment levels, also serum levels of γ-globulins were increased by 32.7±46.9%; range [-24.6]to 162% of the pretreatment levels. On the other hand, serum alkaline phosphatase had decreased by 16.6±29%; range [-88] to 20% of pretreatment levels.

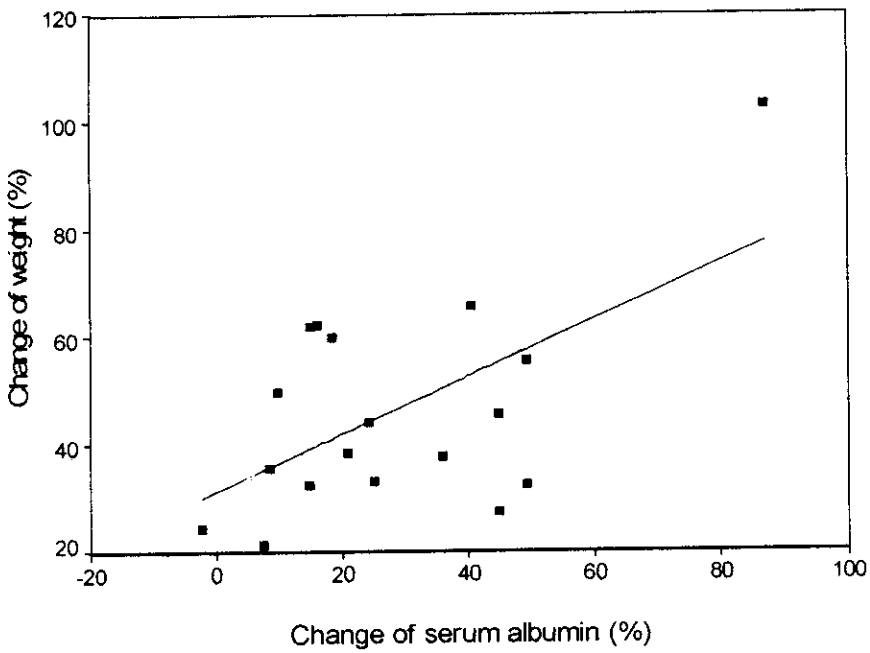


Fig (33): Correlation between % of change occurring in weight of PEM patients and serum albumin.

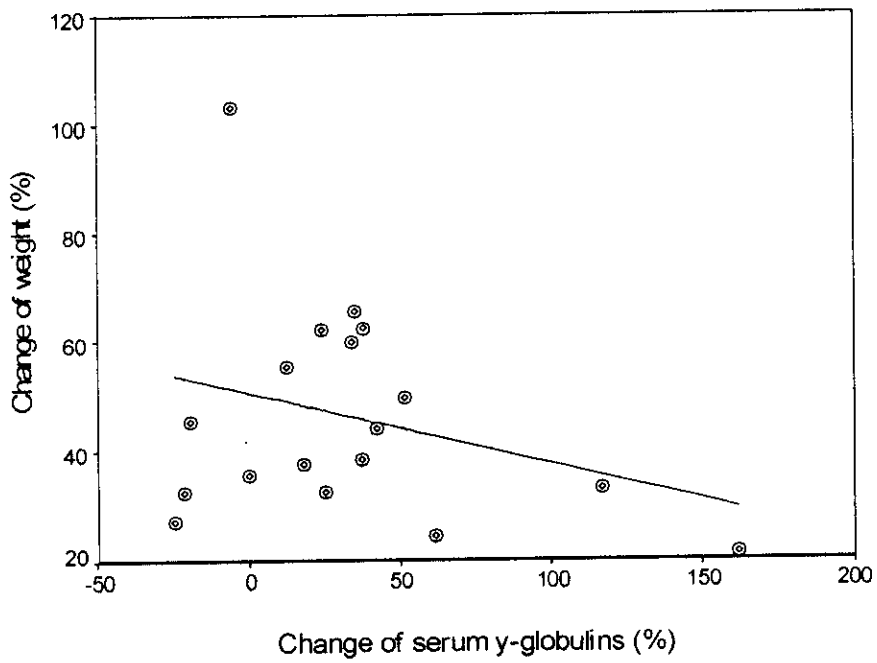


Fig (34): Correlation between % of change occurring in weight of PEM patients and serum γ-globulins.

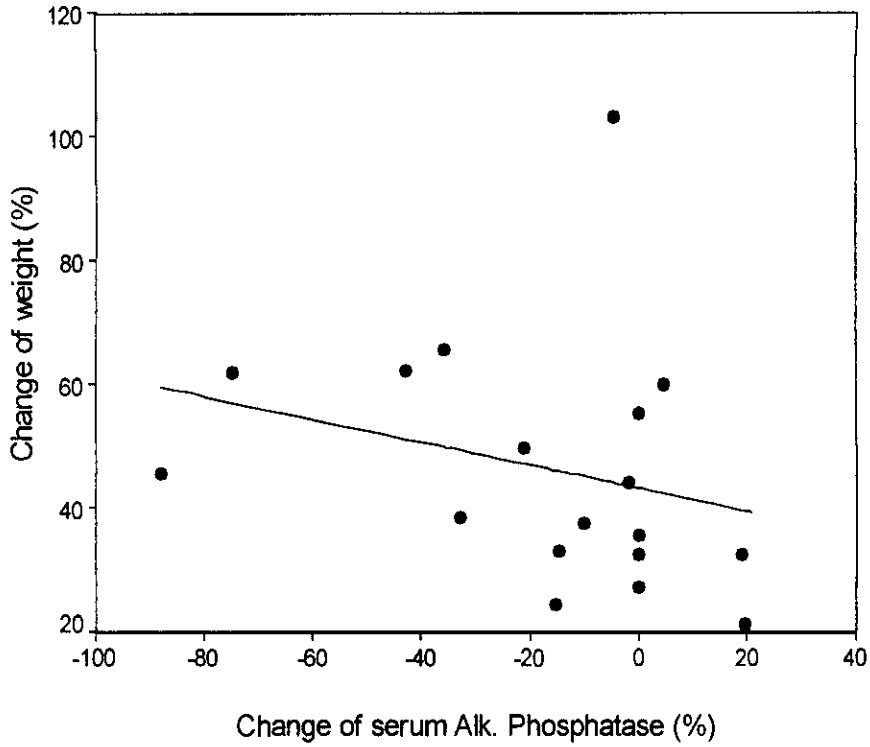


Fig (35): Correlation between % of change occurring in weight of PEM patients and serum alkaline phosphatase.

Table (20): **Backward-regression analysis of the estimated laboratory parameters in relation to post-treatment weight of PEM patients for the most prognostic parameters**

Parameters	Model 1		Model 2a		Model 3b		Model 4b	
	β	P	β	P	β	P	β	P
Albumin	0.615	0.025	0.570	0.012	0.576	0.012	0.576	0.012
Alk. Phosph.	-0.278	0.214	-0.259	0.215				
γ-Globulins	0.085	0.741						

i- γ-Globulin was excluded. β : standardized coefficient

ii- γ-Globulins & alk. Phosphatase were excluded.

Table (20): shows the results of backward-regression analysis of the calculated percentage of change occurring in some laboratory parameters in relation to the percentage of weight changes occurring in PEM patients, using stepwise graduated exclusion of the least significant parameter, for defining the most prognostic parameter. Using regression through 4 models, changes of serum albumin showed the highest significant relation to weight changes reaching a summit at model-2, (β=0.57, P=0.012), and at models-3 & -4, (β=0.576 respectively, P=0.012). The other two parameters were excluded, and the percentage of changes occurring in serum albumin can be considered as the most significant prognostic parameter for the degree of underweight improvement.