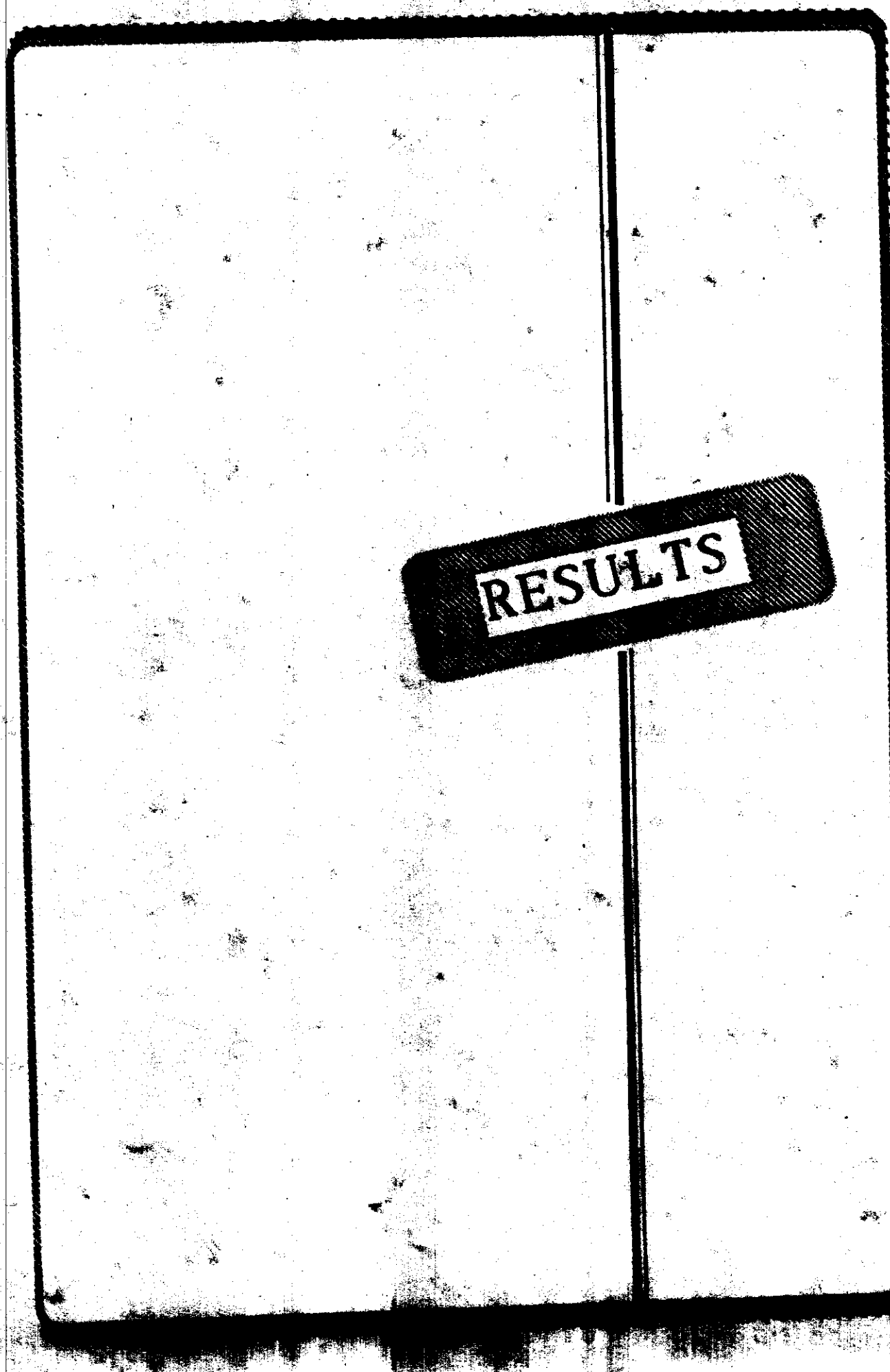
RESULTS

CHAPTER (IV)

RESULTS

A. Serum proteins in control and various thyroid disorder groups before and after surgical correction of the disorders:

Serum levels of total protein, albumin and globulin as well as the calculated A/G ratio for the various thyroid disorder groups are presented as mean value ± SE in tables 3 and 4 for the level before and after operation, respectively. The mean values and standard errors of each parameter for the control group were included in each table for the purpose of comparison.

1. Serum total protein:

No noticeable differences in serum total protein were noticed between groups before the surgical operations (Table 3).

Simple analysis of variance for unequal N was applied to the data to test the significance of the slight differences observed between the mean values of the groups and a summary of the results is presented in table 5. The non significant F obtained from

such analysis indicated that the difference between mean values of the groups could happen by mere chance.

From the inspection of the individual data, it was found that serum protein levels in the normal control ranged from 6.4 to 8.8 g/100 ml. None of the patients in various thyroid disorders showed lower or higher values than the normal range.

The serum total protein mean values after surgical correction of the disorder were very close to the control group. The slight differences observed between all the groups were statistically insignificant as shown from table 6. Paired "t" test showed no significant difference in serum total proteins in any of the thyroid disorders as a function of surgical correction (Table 7).

2. Serum albumin:

In comparison with the control group serum albumin level was slightly lower in various thyroid disorder groups than the control (Table 3). The mean value of the control group was found 5.02 $\pm$ 0.14 g/100 ml. The range obtained from the individual values of the

normal control group was found to be 4.4 to 6.28 g/ 100 ml. From the study of the individual data of various thyroid disorder groups, there were 10.5 %, 12.3 % and 15 % of the cases showing lower values than the normal range in simple goiter, malignant goiter and toxic goiter, respectively. None of the patients in the three groups showed values higher than the observed normal range.

Analysis of variance was applied to the data to test the significance of difference between the means of various groups and showed non significant differences (N.S.) table 8. The post-operative mean values of serum albumin were presented in table 4 and can be compared to table 3 to show any difference occurring as a function of operation.

Paired "t" test was applied to show any significant difference between the pre and post-operative level and showed non significant difference (N.S.) table 7.

3. Serum globulin:

The mean value of serum globulin in control group was found 2.29 $\pm$ 0.09 g/100 ml (Table 3). The mean values of other groups were slightly higher than the

control group. The obtained range for the normal control group was 1.48 to 3.01 g/100 ml. From study of the individual data, the following results were obtained: 16.95 %, 12.9 % and 17.7% of the cases were higher than the normal range in simple goiter, toxic goiter and malignant goiter, respectively. Other cases of various groups were found within the normal range. In applying simple analysis of variance between groups, it was found non significant (Table 9).

The post-operative mean values of various groups were presented in table 4 and can be compared to the pre-operative values in table 3. It shows slight difference.

Paired "t" test was done to show any significant difference between pre and post-operative values (Table 7). It was found non significant.

4. A/G ratio:

No remarkable changes were obtained for the A/G ratio for the various groups (Table 3). The highest value was obtained for the normal control group. Other groups showed slightly lower result than the control group.

There were no significant changes between the pre and post-operative mean values (Table 7).

Table (3): Mean values ± SE's for serum protein levels in control and various thyroid disorders before operation.

Disorder	Total protein g/100 ml	Albumin g/100 ml	Globulin g/100 ml	A/G ratio
Control group	7.36 ± 0.16	5.02 ± 0.14	2.29 ± 0.09	2.29 ± 0.14
Simple nodular goiter group	6.95 ± 0.27	4.49 ± 0.16	2.61 ± 0.12	2.14 ± 0.12
Toxic goiter group	7.11 ± 0.14	4.68 ± 0.11	2.34 ± 0.12	2.11 ± 0.05
Malignant goiter group	7.60 ± 0.21	4.77 ± 0.23	2.95 ± 0.32	2.01 ± 0.19

Table (4): Mean values ± SE's for serum protein levels in control and various thyroid disorders after operation.

Disorder corrected	Total protein g/100 ml	Albumin g/100 ml	Globulin g/100 ml	A/G ratio
Control	7.36 ± 0.16	5.02 ± 0.14	2.29 ± 0.09	2.29 ± 0.14
Simple nodular goiter	7.15 ± 0.17	4.93 ± 0.17	2.29 ± 0.17	2.15 ± 0.13
Toxic goiter	7.27 ± 0.02	4.68 ± 0.02	2.59 ± 0.19	2.00 ± 0.16
Malignant goiter	7.71 ± 0.23	4.67 ± 0.05	2.29 ± 0.36	2.03 ± 0.42

Table (6): Summary of simple analysis of variance for testing the significance of difference between the mean values of serum total protein of control and various thyroid disorders after operation.

Source of variation	Sum of squares	dF	Mean square	F
Between groups	1.118	3	0.373	1.143
Within groups	16.322	50	0.326	N. S.
Total	17.44	53		

Table (7): Summary of results of paired "t" test for testing the significance of difference between pre and post-operative mean values for each protein fraction.

Protein fraction	Comparison between the pre and post-operative mean values		
	Simple nodular goiter	Toxic goiter	Malignant goiter
Total protein	N.S.	N.S.	N.S.
Albumin	N.S.	N.S.	N.S.
Globulin	N.S.	N.S.	N.S.
A/G ratio	N.S.	N.S.	N.S.

Table (8): Summary of simple analysis of variance for testing the significance of difference between the mean values of serum albumin of control and various thyroid disorders before operation.

Source of variation	Sum of squares	dF	Mean square	F
Between groups	2.6802	3	0.898	2.151
Within groups	25. 324	61	0.415	(N.S.)
Total	28.0042	64		

Table (9): Summary of simple analysis of variance for testing the significance of difference between the mean values of serum globulin of control and various thyroid disorders before operation.

Source of variation	Sum of squares	dF	Mean square	F
Between groups	1.984	3	0.661	2.154
Within groups	18.746	61	0.307	(N.S.)
Total	20. 73	64		

B. Serum calcium and inorganic phosphorus in control and various thyroid disorder groups before and after surgical correction of the disorders:

The study of serum calcium and inorganic phosphorus was based on the proved changes taking place in the thyroid disorders and to assess the parathyroid function.

1. Serum calcium (Ca):

The serum level of each calcium and inorganic phosphorus as represented by their means and standard errors for the control and various thyroid disorder groups are presented in table (10).

The observed range from the normal control group was found to be 8.49 mg/100 ml to 10.82 mg/100 ml. From the study of the individual data of various thyroid disorder groups, there were 48.64 % of cases of toxic goiter above the normal range and 51.36 % within this range. In malignant goiter all the cases were found in the normal range. But in simple goiter 3.85 % of cases were found above the normal range and 96.15 % of cases were found within the normal range.

Analysis of variance was applied to the data to test the significant statistical difference between groups and presented in table (11). Significant ($P < 0.01$) was obtained indicating significant difference between the means. To find which mean differs from others, a multiple range "t" test was applied (Table 12). The significant differences were obtained when mean values for cases of toxic goiter were compared with control, simple and malignant goiter mean values ($P < 0.01$). But there were no significant differences between other groups.

Post-operative mean values were presented in table 13.

Paired "t" test was done to show any significant changes between pre and post-operative levels. It showed significant statistical difference between pre and post-operative serum calcium in toxic goiter cases and malignant goiter cases ($P < 0.01$) and ($P < 0.05$) respectively (Table 14). But there was no significant difference in simple nodular goiter cases.

2. Serum inorganic phosphorus (IP):

The mean values of serum inorganic phosphorus in control and various thyroid disorders were presented in table (10). The observed range from the normal control group was found to be 3.2 mg/100 ml - 4.72 mg/100 ml. In simple nodular goiter 6.92 % of the cases were found higher than the normal range and 93.08 % of cases found within the normal range. In toxic goiter 47.27 % of the cases were found higher than the normal range and 52.73 % of cases were found within the normal range. In malignant goiter 5% of cases were found higher than the normal range and 95 % of cases were found within the normal range.

Simple analysis of variance was done to test if there was any significant statistical differences between the means of different groups and was found significant ($P < 0.01$) table 15.

Multiple range "t" test was done to show which mean differs from which. It showed significant difference ($P < 0.01$) when toxic goiter values were compared with control, simple goiter and malignant goiter values (Table 16). The post-operative mean values and standard error were presented in table 13.

Paired "t" test was done to show significant difference between pre and post-operative mean values. It was found significant in toxic goiter group ($P < 0.01$) but non significant in other groups (Table 14).

3. Calcium/Phosphorus ratio (Ca/IP ratio):

The mean values of Ca/P ratio were presented in table 10. It showed that the control, simple nodular goiter, toxic goiter and malignant goiter values were close to each other.

In applying simple analysis of variance to show the minor significant difference, it was found non significant (Table 17). The post-operative mean value was presented in table (13).

To show if any significant difference between pre and post-operative values paired "t" test was done. It was found non significant (table 14).

Table (10): Mean values ± SE's for serum calcium, inorganic phosphorus and Ca/P ratio levels in control and various thyroid disorders before operation.

Disorder	Calcium mg/100 ml	Phosphorus mg/100 ml	Ca/IP ratio
Control group	9.53 ± 0.12	3.86 ± 0.09	2.48 ± 0.06
Simple nodular goiter group	9.67 ± 0.16	4.22 ± 0.25	2.36 ± 0.10
Toxic goiter group	10.83 ± 0.16	5.53 ± 0.32	2.26 ± 0.15
Malignant goiter group	9.734 ± 0.12	4.53 ± 0.33	2.35 ± 0.15

Table (11): Summary of simple analysis of variance for testing the significance of difference between the mean values of serum calcium of control and various thyroid disorders before operation.

Source of variation	Sum of squares	dF	Mean square	F
Between groups	22.1439	3	7.381	18.316**
Within groups	24.558	61	0.403	
Total	46.702	64		

** $P < 0.01$.

Table (12): Summary of multiple range "t" test for testing the significance of difference between each two serum calcium mean values of the control and various thyroid disorders before operation.

Group	Simple nodular goiter	Toxic goiter	Malignant goiter
Control	N.S.	P<0.01	N.S.
Simple nodular goiter		P<0.01	N.S.
Toxic goiter			P<0.01

Table (13): Mean values ± SE's for serum calcium, inorganic phosphorus and Ca/IP ratio levels in control and various thyroid disorders after operation.

Disorder corrected	Calcium mg/100 ml	Phosphorus mg/100 ml	Ca/IP ratio
Control	9.53 ± 0.12	3.864 ± 0.09	2.48 ± 0.06
Simple nodular goiter	9.46 ± 0.15	4. 18 ± 0.19	2.33 ± 0.44
Toxic goiter	9.83 ± 0.19	4.79 ± 0.32	2.14 ± 0.20
Malignant goiter	8.28 ± 0.06	4.99 ± 0.26	1.68 ± 0.08

Table (14): Summary of results of paired "t" test for testing the significance of difference between the pre and post - operative mean values for each Ca, IP and Ca/P ratio.

Parameter	Comparison between the pre and post-operative mean values		
	Simple nodular goiter	Toxic goiter	Malignant goiter
Ca	N.S.	<0.01	<0.05
IP	N.S.	<0.01	N.S.
Ca/IP	N.S.	N.S.	N.S.

Table (15): Summary of simple analysis of variance for testing the significance of difference between the mean values of serum inorganic phosphorus of control and various thyroid disorders before operation.

Source of variation	Sum of squares	dF	Mean square	F
Between groups	16.324	3	5.141	5.788**
Within groups	57. 31	61	0.940	
Total	73.634			

** $P < 0.01$.

Table (16): Summary of multiple range "t" test for testing the significance of difference between each two serum inorganic phosphorus mean values of the control and various thyroid disorders before operation.

Group	Simple nodular goiter	Toxic goiter	Malignant goiter
Control	N.S.	P<0.01	N.S.
Simple nodular goiter		P<0.01	N.S.
Toxic goiter			P<0.01

Table (17): Summary of simple analysis of variance for testing the significance of difference between the mean values of Ca/IP ratio of control and various thyroid disorders before operation.

Source of variation	sum of squares	dF	Mean square	F
Between groups	6.324	3	2.108	2.243
Within groups	57. 31	61	0.940	N.S.
Total	63.634	64		

Multiple range "t" test was done to show the difference between groups table (20). It was found that any group was significantly different in comparison with the toxic group. But there were no other significant differences.

The post-operative mean values for total serum thyroxine were presented in table (21). It showed big difference between the control group and malignant group, but slight difference between control, toxic and simple nodular goiter groups.

Simple analysis of variance was done and showed significant difference ($P < 0.01$) table (22). To show which value differs from which multiple range "t" test was applied and showed significant difference in comparison between each group and the malignant group values. There was no significant difference between other groups (Table 23).

When paired "t" test was applied to show the significant difference between pre and post-operative values, it was found significant in toxic goiter group ($P < 0.01$) and significant in malignant group ($P < 0.01$) but non significant in simple nodular group (Table 24).

2. Serum triiodothyronine (T_3):

The mean values of serum triiodothyronine in control and various thyroid disorders were presented in table (18).

From study of the individual data of the control group, the normal range was found to be 90 ng/100 ml to 165 ng %. On inspection of the data of different groups; all cases of toxic goiter were found higher than the normal range, about 18.3 % of the cases of simple nodular goiter were slightly higher than the normal range and 81.7 % were within the normal range. In malignant goiter group about 5% of cases showed higher values than the normal range and 95 % of the cases were found within the normal range.

Simple analysis of variance was applied to test the significant difference between groups. It was found significant ($P < 0.01$); table (25).

On applying the multiple range "t" test to show which group differs from which, all groups showed significant difference when compared with toxic group, but no other significant differences were found (Table 26).

The post-operative mean values for serum triiodothyronine were presented in table (21). It showed no apparent difference between control group, simple nodular goiter, toxic goiter group, but there is apparent difference between these groups and malignant goiter.

In applying simple analysis of variance to show the significance of minor degree of difference between the groups, (table 27), it was found significant ($P < 0.05$). Then multiple range "t" test was done to show which group differed from which. Malignant goiter group showed significant difference in comparison to all groups; table (28). There was no difference in comparison of other groups with each other.

To show the difference between pre and post-operative values, paired "t" test was applied. It was found significant in toxic goiter group and malignant group but non significant in simple nodular goiter group ($P < 0.01$), table 24.

Table (18): Mean values ± SE's for serum total thyroxine (T_4) and serum triiodothyronine (T_3) levels in control and various thyroid disorders before operation.

Disorder	Total thyroxine (T_4) ug/100 ml	Triiodothyronine (T_3) ng/100 ml
Control group	8.24 ± 0.45	134.13 ± 6.36
Simple nodular goiter group	8.73 ± 0.31	146.76 ± 9.74
Toxic goiter group	16.08 ± 0.73	318.64 ± 14.93
Malignant goiter group	6.21 ± 0.79	140.69 ± 21.39

Table (19): Summary of simple analysis of variance for testing the significance of difference between the mean values of serum total thyroxine (T_4) of control and various thyroid disorders before operation.

Source of variation	Sum of squares	dF	Mean square	F
Between groups	761.60	3	253.87	99.81**
Within groups	224.07	59	3.80	
Total	985.67	62		

** $P < 0.01$.

Table (20): Summary of multiple range "t" test for testing the significance of difference between each two serum total thyroxine mean values of the control and various thyroid disorders before operation.

Group	Simple nodular goiter	Toxic goiter	Malignant goiter
Control	N.S.	<0.01	N.S.
Simple nodular goiter		<0.01	N.S.
Toxic goiter			<0.01

Table (21): Mean values ± SE's for serum total thyroxine and triiodothyronine levels in control and various thyroid disorders after operation.

Disorder corrected	Total thyroxine (T_4) ug/100 ml	Triiodothyronine (T_3) ng/100 ml
Control	8.24 ± 0.45	134.13 ± 6.36
Simple nodular goiter	7.65 ± 0.32	133.47 ± 13.86
Toxic goiter	7.45 ± 0.62	130.56 ± 10.31
Malignant goiter	0.75 ± 0.13	65 ± 8.42

Table (22): Summary of simple analysis of variance for testing the significance of difference between the mean values of serum total thyroxine of control and various thyroid disorders after operation.

Source of variation	Sum of squares	dF	Mean square	F
Between groups	265. 79	3	88.597	30.52**
Within groups	145. 23	50	2.904	
Total	411.028	53		

** P<0.01.

Table (23): Summary of multiple range "t" test for testing the significance of difference between each two serum total thyroxine mean values of the control and various thyroid disorders after operation.

Group	Simple nodular goiter	Toxic goiter	Malignant goiter
Control	N.S.	N.S.	<0.01
Simple nodular goiter		N.S.	<0.01
Toxic goiter			<0.01

Table (25): Summary of simple analysis of variance for testing the significance of difference between the mean values of serum triiodothyronine of control and various thyroid disorders before operation.

Source of variation	Sum of squares	dF	Mean square	F
Between groups	234033.6	3	78011.2	43.77**
Within groups	83761.8	47	1782.2	
Total	317795.4	50		

** P < 0.01.

Table (26): Summary of multiple range "t" test for testing the significance of difference between each two serum triiodothyronine mean values of the control and various thyroid disorders before operation.

Group	Simple nodular goiter	Toxic goiter	Malignant goiter
Control	N.S.	<0.01	N.S.
Simple nodular goiter		<0.01	N.S.
Toxic goiter			<0.01

Table (27): Summary of simple analysis of variance for testing the significance of difference between the mean values of serum triiodothyronine of control and various thyroid disorders after operation.

Source of variation	Sum of squares	dF	Mean square	F
Between groups	14637.43	3	4879.17	3.38**
Within groups	56291.69	39	1443.38	
Total	70929.12	42		

** $P < 0.05$.

Table (28): Summary of multiple range "t" test for testing the significance of difference between each two serum triiodothyronine mean values of the control and various thyroid disorders after operation.

Group	Simple nodular goiter	Toxic goiter	Malignant goiter
Control	N.S.	N.S.	<0.01
Simple nodular goiter		N.S.	<0.05
Toxic goiter			<0.01

D. Serum parathyroid hormone in control and various thyroid disorder groups before and after operation:

The mean values of serum parathyroid hormone in control group and various thyroid disorder groups were presented in table (29). The mean value of simple nodular goiter group and malignant goiter group were close to the mean value of control group. But the mean value of the toxic goiter group was lower than that of the control group.

The obtained range of the control group was found 1.85 to 2.15 m UI/ml. From study of the individual data of different groups, we found about 43.23 % of cases of toxic goiter group showing lower values than the obtained range and 56.77 % of cases were found within the normal range. The simple nodular goiter and malignant cases were found within the normal range.

Simple analysis of variance was applied and showed significant difference between groups ($P < 0.01$) table 30. To show which mean differed from which multiple range "t" test was applied and showed significant difference when toxic goiter group mean value

was compared with control, simple nodular goiter group and malignant goiter group mean values ($P<0.01$), table (31). But there were no other significant differences.

The post-operative mean values were presented in table (29). Toxic goiter group and simple nodular goiter mean values were close to the control mean value but malignant goiter mean value showed marked difference. Simple analysis of variance was applied to the post-operative values and was found significant ($P<0.01$), table (32). To show which mean differed from which multiple range "t" test was done. Significant difference was obtained when malignant goiter was compared with other groups ($P<0.05$); table (33). To show if any significant difference between the pre and post-operative mean values, paired "t" test was applied and was found significant in toxic goiter group ($P<0.01$) and in malignant goiter group ($P<0.01$) but non significant in simple nodular goiter group (Table 34).

Table (29): Mean values ± SE's for serum parathyroid hormone levels in control and various thyroid disorders before and after operation.

Disorder	Serum parathyroid hormone before operation (m UI/ml)	Serum parathyroid hormone after operation (m UI/ml)
Control group	1.97 ± 0.07	
Simple nodular goiter group	2.26 ± 0.16	2.26 ± 0.15
Toxic goiter group	1.25 ± 0.16	2.22 ± 0.29
Malignant goiter group	2.15 ± 0.16	1.16 ± 0.36

Table (30): Summary of simple analysis of variance for testing the significance of difference between the mean values of serum parathyroid hormone of control and various thyroid disorders before operation.

Source of variation	Sum of squares	dF	Mean squares	F
Between groups	4.789	3	2. 39	12.445**
Within groups	4.036	40	0.192	
Total	8.825	43		

** P < 0.01.

Table (31): Summary of multiple range "t" test for testing the significance of difference between each two serum parathyroid hormone mean values of the control and various thyroid disorders before operation.

Group	Simple nodular goiter	Toxic goiter	Malignant goiter
Control	N.S.	<0.01	N.S.
Simple nodular goiter		<0.01	N.S.
Toxic goiter			<0.01

Table (32): Summary of simple analysis of variance for testing the significance of difference between the mean values of serum parathyroid hormone of control and various thyroid disorders after operation.

Source of variation	Sum of squares	dF	Mean square	F
Between groups	3.507	3	1.75	6.986**
Within groups	10.020	40	0.2505	
Total	13.527	43		

** $P < 0.01$.

Table (33): Summary of multiple range "t" test for testing the significance of difference between each two serum parathyroid hormone mean values of the control and various thyroid disorders after operation.

Group	Simple nodular goiter	toxic goiter	Malignant goiter
Control	N.S.	N.S.	P<0.05
Simple nodular goiter		N.S.	P<0.05
Toxic goiter			P<0.05

Table (34): Summary of results of paired "t" test for testing the significance of difference between pre and post-operative mean values for serum parathyroid hormone.

	Comparison between the pre and post-operative mean values		
	Simple nodular goiter	Toxic goiter	Malignant goiter
Serum parathyroid hormone	N.S.	< 0.01	< 0.01

E. Correlation coefficient between different parameters in toxic goiter group: (Table 35)

1. Correlation coefficient test was applied between T_4 and serum calcium and positive correlation was found between them ($P<0.01$) i.e. if serum T_4 increased, serum calcium would increase (Figure 3).

2. Correlation coefficient test was applied between T_4 and serum IP and positive correlation was found ($P<0.01$) i.e. when serum T_4 increased, serum IP would increase (Figure 4).

3. Correlation coefficient test was applied between T_4 and Si PTH and negative correlation was found ($P<0.01$) i.e. if serum T_4 increased, Si PTH would decrease (Figure 5).

4. Correlation coefficient test was applied between serum T_3 and serum Ca and positive correlation was found ($P<0.01$) i.e. if serum T_3 increased, serum Ca would increase (Figure 6).

5. Correlation coefficient test was applied between serum T_3 and serum IP and positive correlation was found ($P<0.01$) i.e. if T_3 increased, serum IP would increase (Figure 7).

6. Correlation coefficient test was applied between serum T_3 and Si PTH and negative correlation was obtained ($P < 0.01$) i.e. if serum T_3 increased, Si PTH would decrease (Figure 8).

7. Correlation coefficient test was applied between serum Ca and Si PTH and negative correlation was found ($P < 0.01$) i.e. if serum Ca increased, Si PTH would decrease (Figure 9).

F. Correlation coefficient between different parameters in simple nodular goiter group and malignant goiter group:

No significant correlation was found between different parameters in both groups.

G. Radiological finding:

No specific radiological finding was found after X-ray examination of the hands, skull and clavicle. Also there was no finding in radiological examination of the urinary tract.

Table (35): Correlation coefficiency between thyroid function tests and serum calcium, serum phosphorus and serum parathyroid hormone.

	Serum calcium	Serum phosphorus	Serum parathyroid hormone
Serum total thyroxine	R 0.984 P < 0.01	R 0.969 P < 0.01	R 0.915 P < 0.01
Serum triiodothyronine	R 0.990 P < 0.01	R 0.929 P < 0.01	R 0.884 P < 0.01
Serum calcium	-	-	R 0.938 P < 0.01

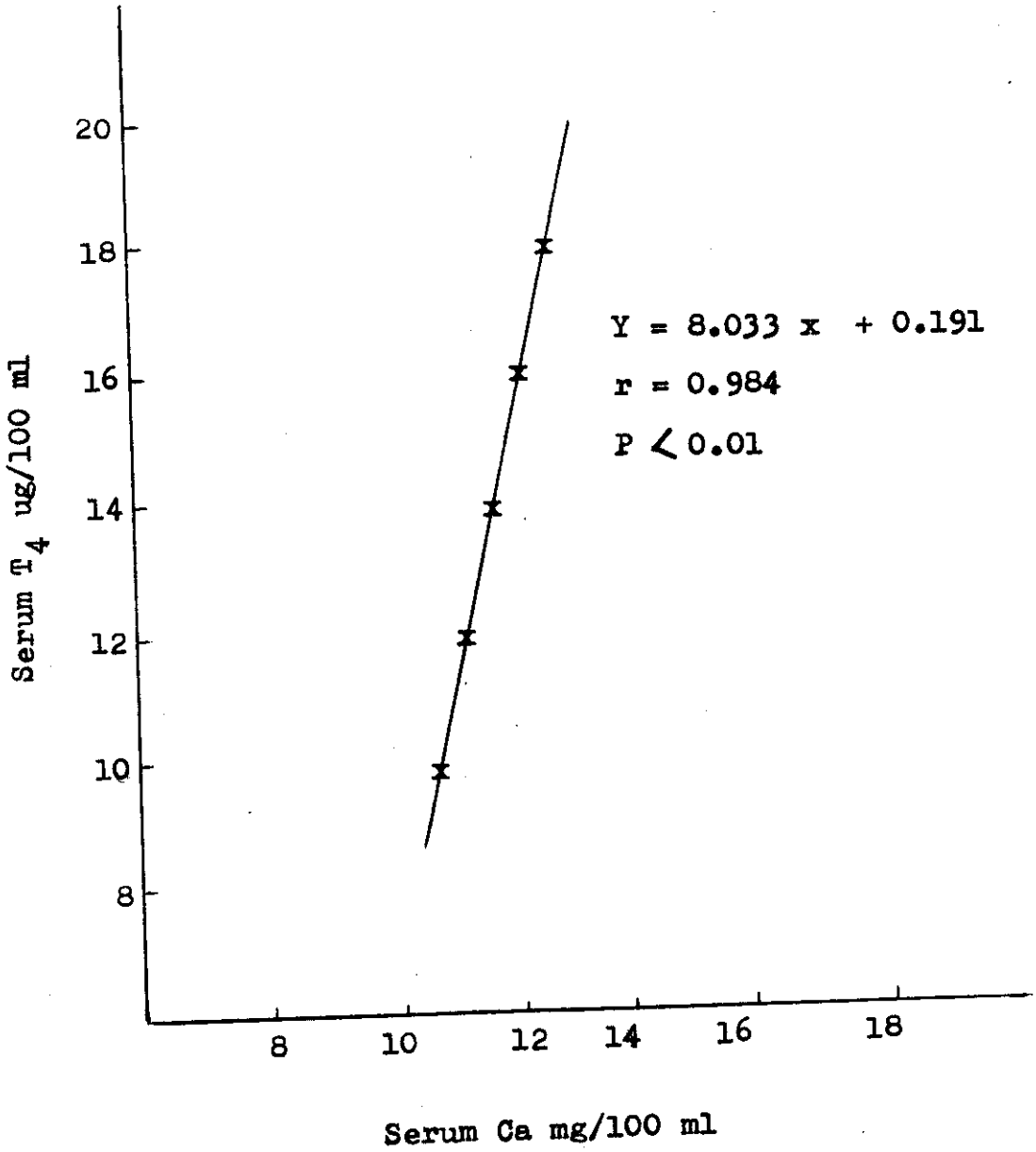

Fig. 3: Correlation coefficient between serum T_4 & serum Ca.

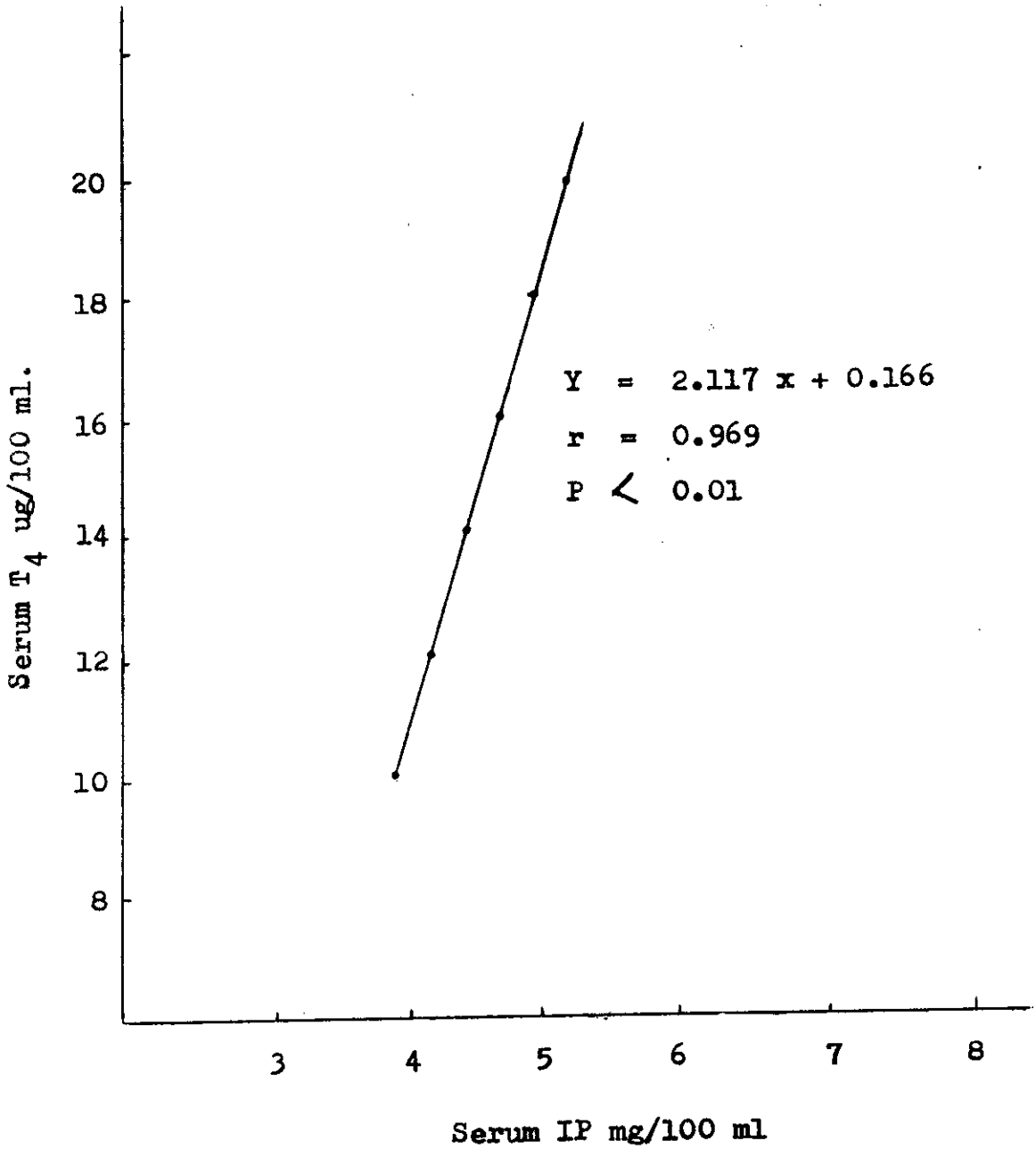

Fig. 4: Correlation coefficient between serum T_4 & IP.

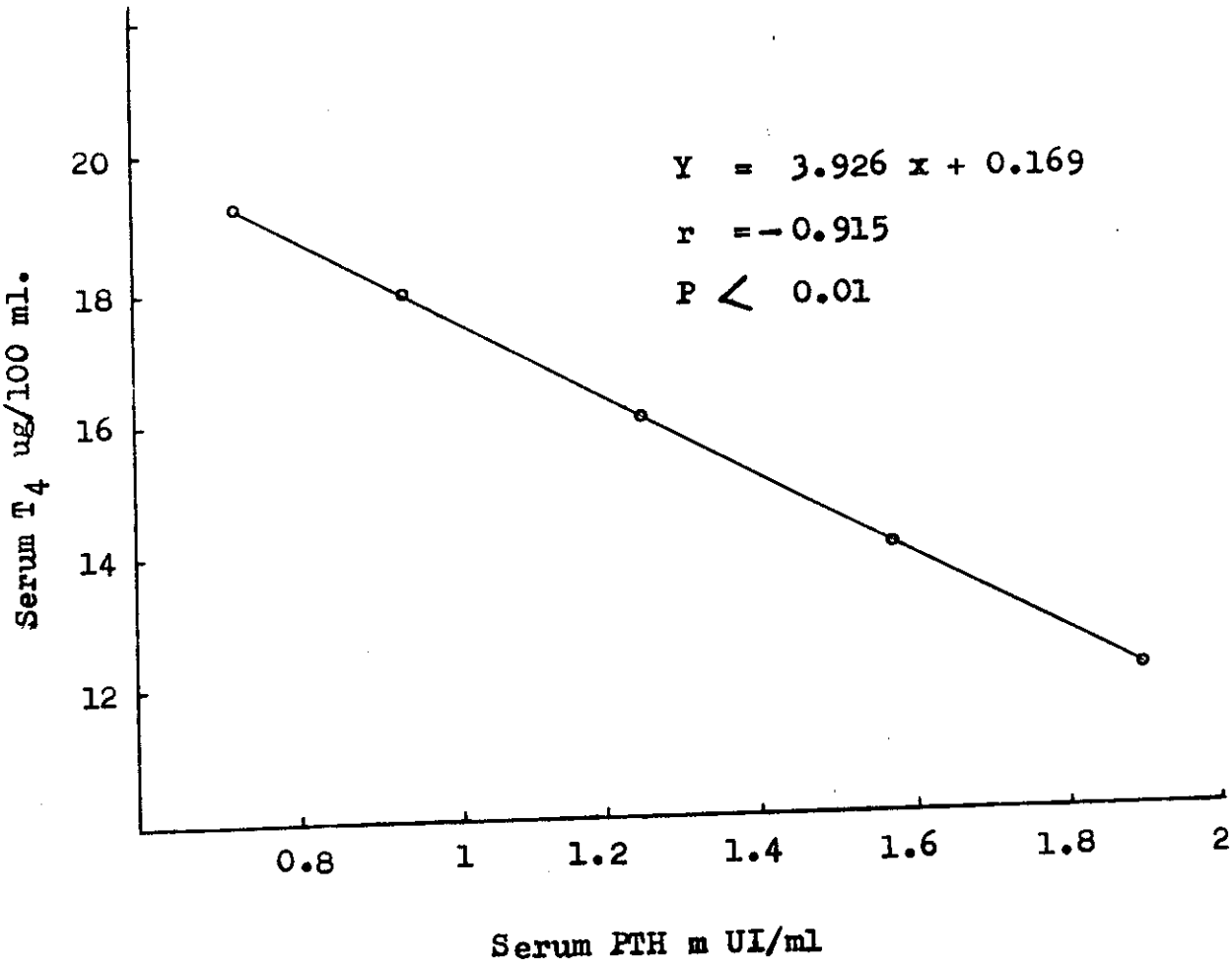

Fig. 5: Correlation coefficient between serum T_4 & Si PTH.

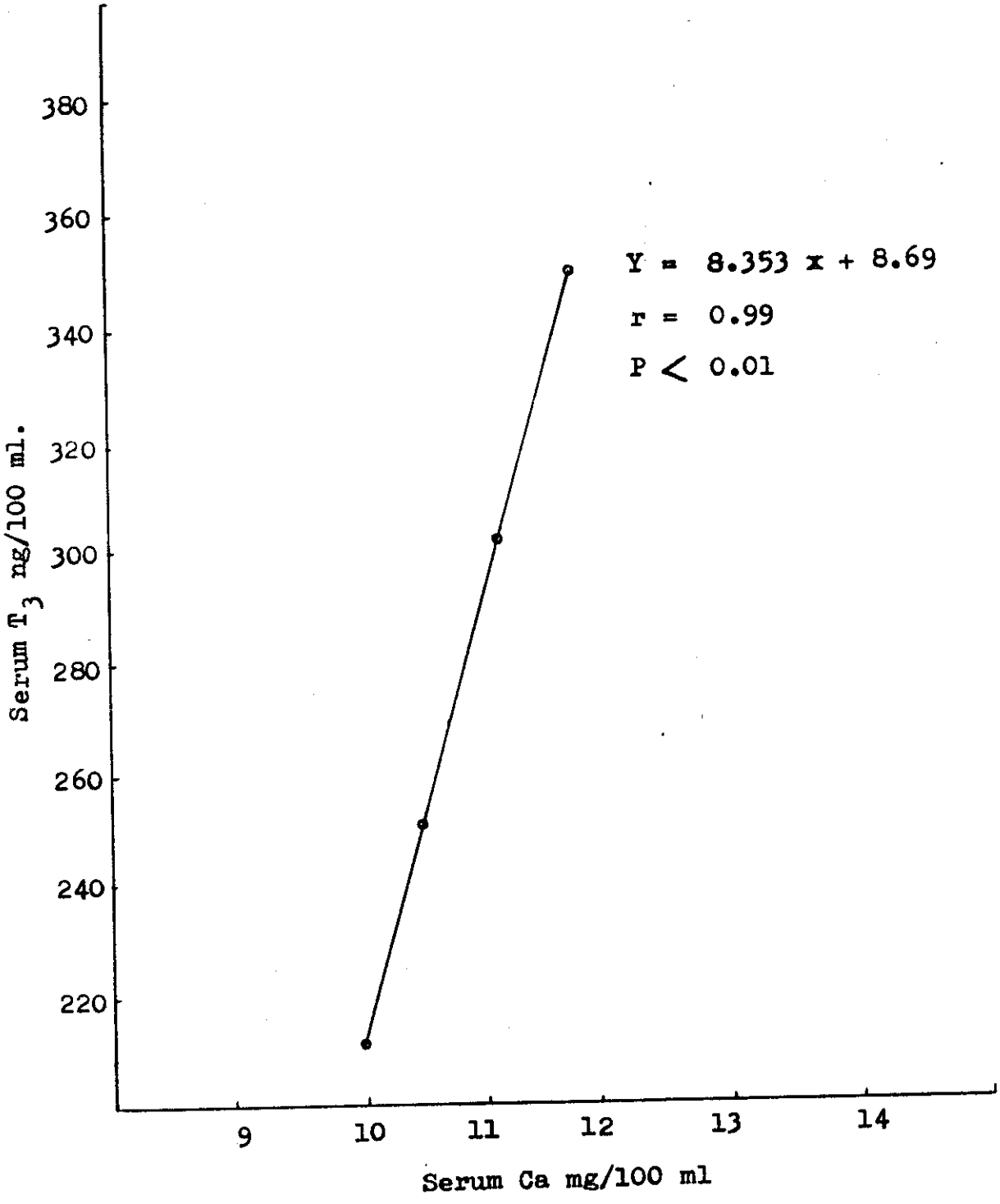

Fig. 6: Correlation coefficient between serum T_3 & serum Ca.

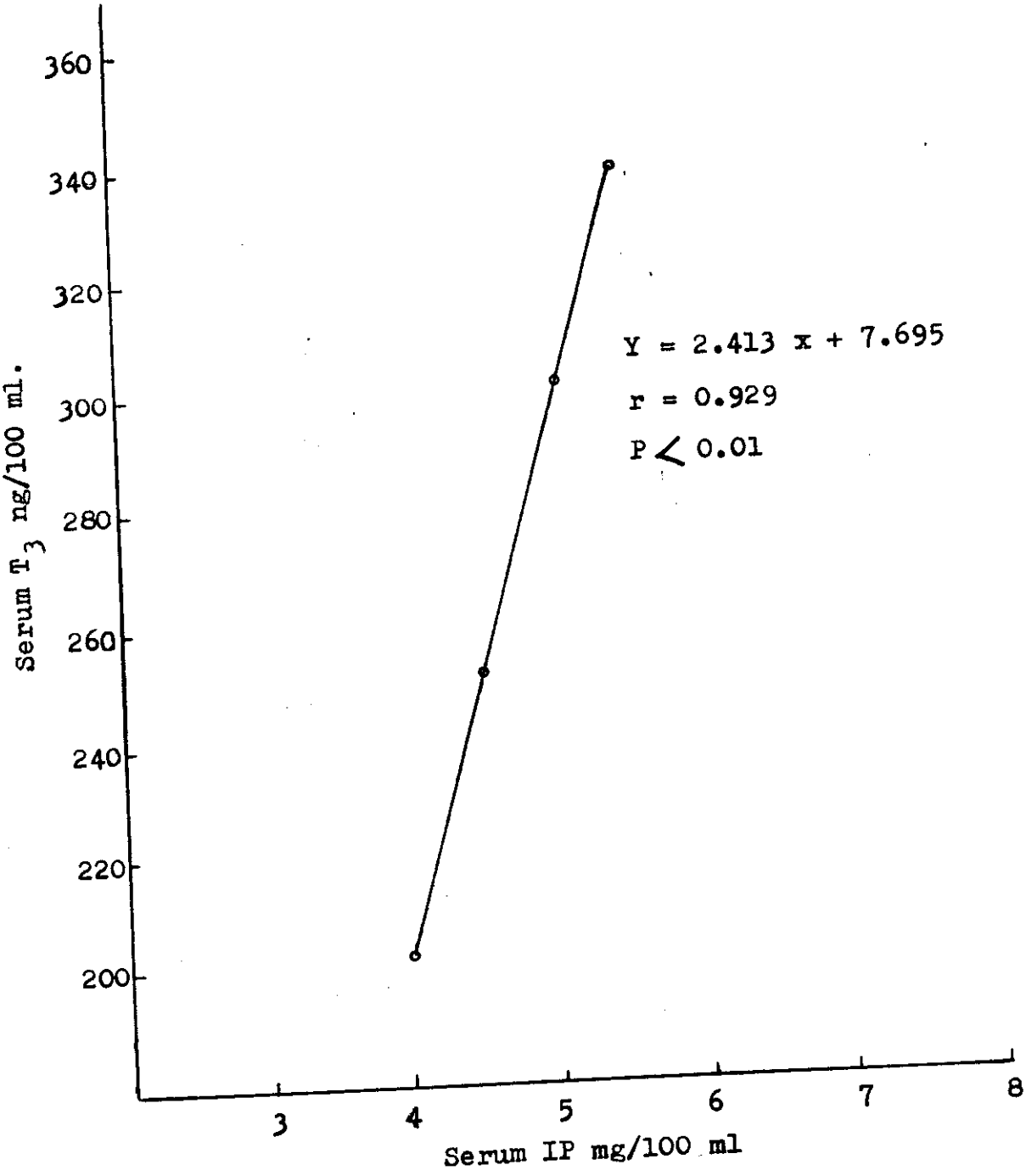

Fig. 7: Correlation coefficient between serum T_3 & serum IP.

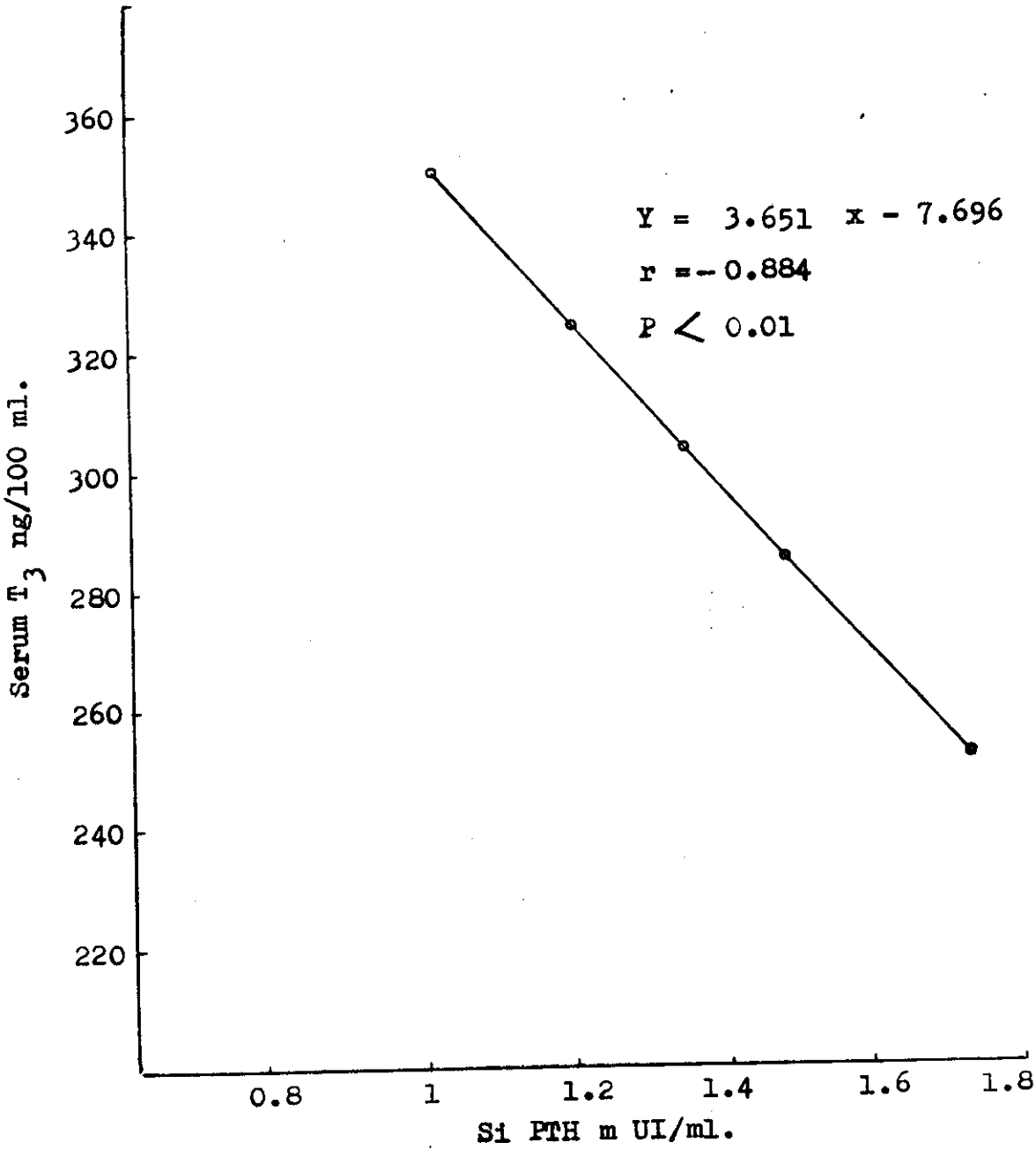

Fig. 8: Correlation coefficient between serum T_3 & Si PTH.

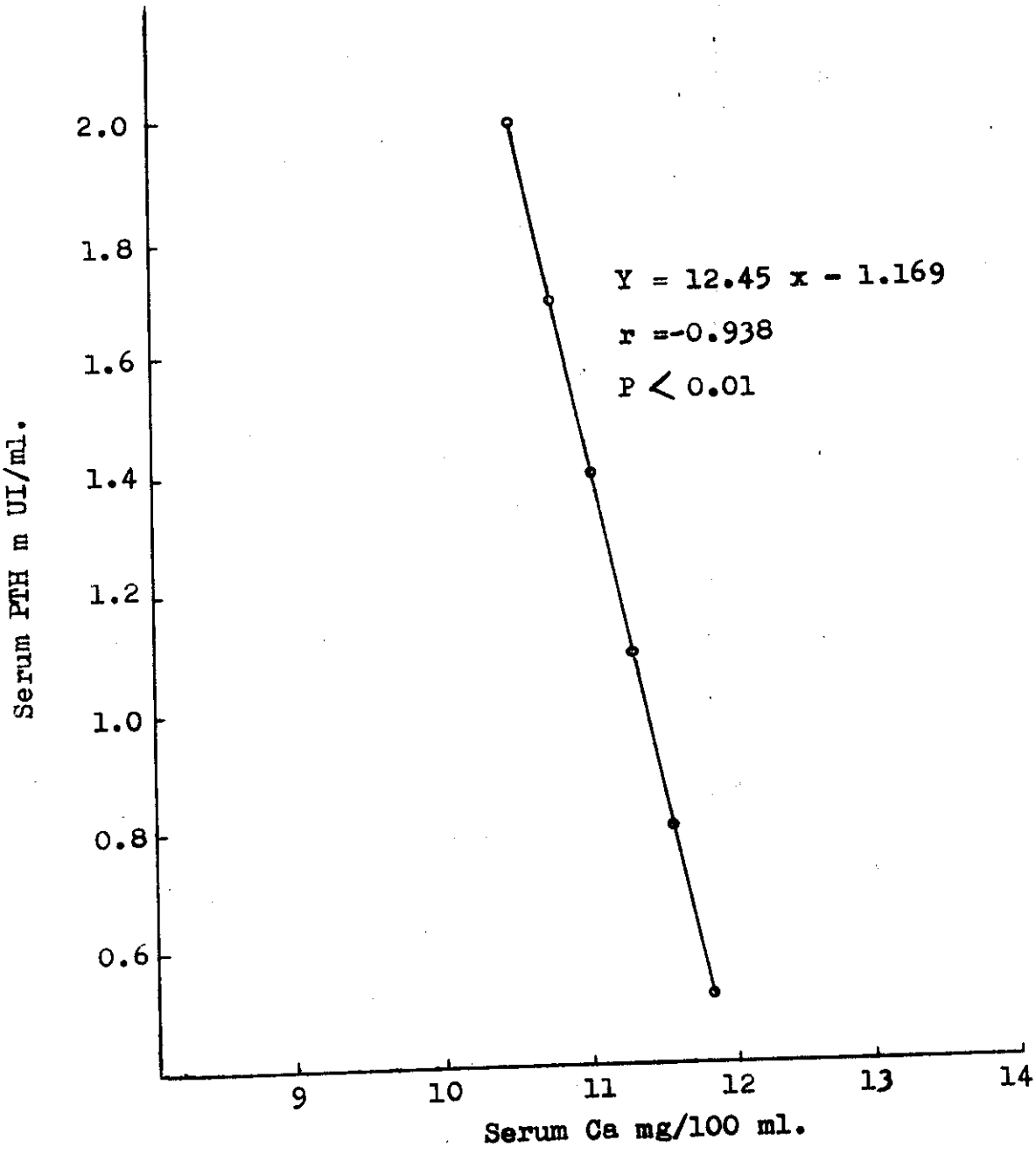

Fig. 9: Correlation coefficient between serum Ca & Si PTH.