

## *Results*

This study has been carried out to investigate the effects of testosterone replacement on growth hormone and prolactin responses to exercise in castrated male rats. Seven rat groups were used, each included eight animals. Serum growth hormone and prolactin levels were measured in all rats. The results are shown in the following: -

### *Group (1): Control rats: -*

The results are shown in tables (8 & 16) and figures (1 & 2). It can be seen that the mean value of serum GH levels in this group is  $8.321 \pm 2.521$  ng/ml and the mean value of serum PRL is  $4.131 \pm 2.120$  ng/ml.

### *Group (2): Exercised sham castrated rats:-*

The results are shown in tables (8 & 16) and Figures (3 & 4). In this group the mean value of serum GH is  $11.020 \pm 3.755$  ng/ml and the mean value of serum prolactin is  $6.214 \pm 2.061$  ng/ml. Serum levels of GH in control rats and in castrated rats are compared with the corresponding values in exercised sham castrated rats table (2) and figure (2). It is clear that exercise resulted in significant increase in serum GH  $11.02 \pm 3.755$  ng/ml than the

control and castrated groups  $8.321 \pm 2.521$  and  $4.101 \pm 1.230$  ng/ml respectively ( $P < 0.05$ ).

Serum levels of PRL in control and castrated rats are compared with the corresponding values in exercised sham castrated rats table (10) and figure (10). It is clear that exercise resulted in significant increase in serum PRL  $6.214 \pm 2.061$  ng/ml than the control group  $4.131 \pm 2.120$  ng/ml ( $P < 0.05$ ) and insignificant increase than the castrated group ( $P > 0.05$ ).

### *Group (3): Castrated rats:-*

The results are shown in tables (8 & 16) and Figures (5 & 6). In this group the mean value of serum GH is  $4.101 \pm 1.230$  ng/ml and the mean value of serum prolactin is  $3.925 \pm 1.614$  ng/ml. Serum levels of GH in control rats are compared with the corresponding values in castrated rats as shown in table (1) and figure (1). It is clear that castration resulted in significant decrease in serum GH  $4.101 \pm 1.230$  ng/ml than the control group  $8.321 \pm 2.521$  ng/ml ( $P < 0.05$ ). Serum levels of PRL in control rats are compared with the corresponding values in castrated rats as shown in table (9) and figure (9). It is clear that castration resulted in insignificant decrease in serum PRL  $3.925 \pm 1.614$  ng/ml than the

control group  $4.131 \pm 2.120$  ng/ml but the decrease was insignificant ( $P > 0.05$ ).

*Group (4): Exercised castrated rats: -*

The results are shown in tables (8 & 16) and figures (7 & 8). It can be seen that the mean value of serum GH levels in this group is  $5.031 \pm 2.680$  ng/ml and the mean value of serum PRL is  $5.986 \pm 1.701$  ng/ml.

Serum levels of GH in control and castrated rats are compared with the corresponding values in exercised castrated rats table (3) and figure (3). It is clear that exercise in castrated rats resulted in increase in serum GH  $5.031 \pm 2.680$  ng/ml than the castrated group  $4.101 \pm 1.230$  ng/ml but the level still below the control group  $8.321 \pm 2.521$ . Serum levels of PRL in control rats and in castrated rats are compared with the corresponding values in exercised castrated rats table (11) and figure (11). It is clear that exercise in castrated rats resulted in significant increase in serum PRL  $5.986 \pm 1.701$  ng/ml compared with control and castrated groups  $4.131 \pm 2.120$  ng/ml ( $P < 0.05$ ) and  $3.925 \pm 1.614$  ( $P < 0.05$ ).

*Group (5): Exercised castrated testosterone replaced rats: -*

The results are shown in tables (8 & 16) and figures (9 & 10).

It can be seen that the mean value of serum GH levels in this group  $10.98 \pm 3.496$  is ng/ml and the mean value of serum PRL is  $5.946 \pm 2.011$  ng/ml.

Serum levels of GH in control and castrated rats are compared with the corresponding values in exercised castrated testosterone replaced rats as shown in table (4) and figure (4). It is clear that testosterone replacement in exercised castrated rats resulted in significant increase in serum GH  $10.98 \pm 3.496$  ng/ml than the castrated group  $4.101 \pm 1.230$  ng/ml ( $P < 0.05$ ) and insignificant increase than the control group  $8.321 \pm 2.521$ . Serum levels of PRL in control and castrated rats are compared with the corresponding values in exercised castrated testosterone replaced rats as shown in table (12) and figure (12). It is clear that testosterone replacement in exercised castrated rats resulted in insignificant increase in serum PRL  $6.511 \pm 3.241$  ng/ml compared with the control and castrated groups  $4.131 \pm 2.120$  ng/ml. and  $3.925 \pm 1.614$  ( $P > 0.05$ ).

*Group (6): Exercised castrated double dose testosterone replaced rats: -*

The results are shown in tables (8 & 16) and figure (11 & 12). It can be seen that the mean value of serum GH levels in this group is  $13.50 \pm 4.357$  ng/ml and the mean value of serum PRL is  $6.511 \pm 3.241$  ng/ml.

Serum levels of GH in control and castrated rats are compared with the corresponding values in exercised castrated double dose testosterone replaced rats as shown in table (5) and figure (5). It is clear that double dose testosterone replacement in exercised castrated rats resulted in significant increase in serum GH  $13.50 \pm 4.357$  ng/ml compared with the control and castrated groups  $5.031 \pm 2.680$  ng/ml ( $P < 0.001$ ) and  $8.321 \pm 2.521$  ( $P < 0.01$ ). Serum levels of PRL in control rats are compared with the corresponding values in exercised castrated double dose testosterone replaced rats as shown in table (13) and figure (13). It is clear that double dose testosterone replacement in exercised castrated rats resulted in significant increase in serum PRL  $6.511 \pm 3.241$  ng/ml compared

with the control and castrated groups  $4.131 \pm 2.120$  ng/ml ( $P < 0.05$ ) and  $3.925 \pm 1.614$  ng/ml.

*Group (7): Exercised castrated half dose testosterone replaced rats: -*

The results are shown in tables (8 & 16) and figures (13 & 14). It can be seen that the mean value of serum GH levels in this group is  $6.919 \pm 4.607$  ng/ml and the mean value of serum PRL is  $5.2381 \pm 2.071$  ng/ml.

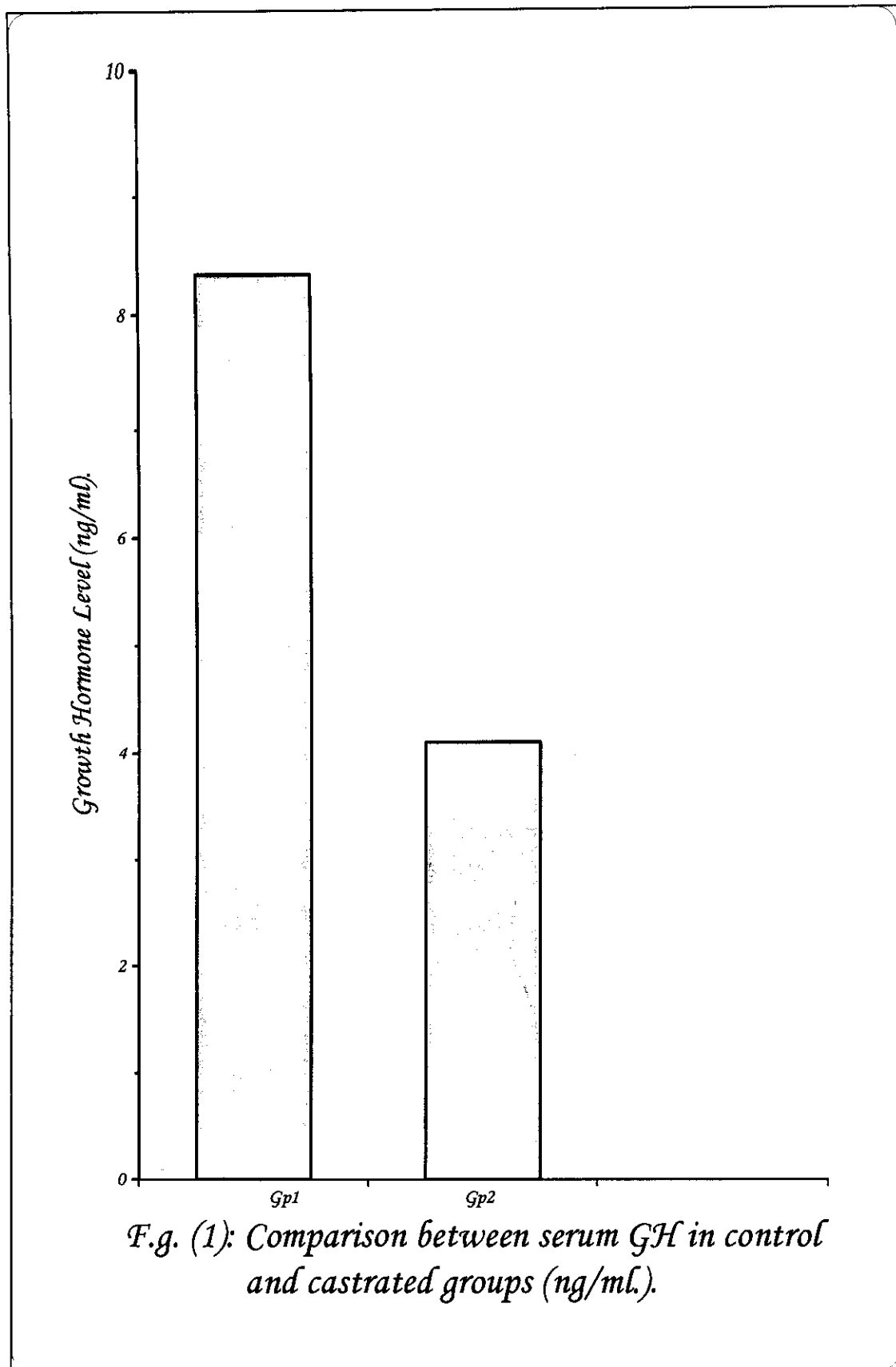
Serum levels of GH in control and castrated rats are compared with the corresponding values in exercised castrated half dose testosterone replaced rats as shown in table (6) and figure (6). It is clear that half dose testosterone replacement in exercised castrated rats resulted in insignificant increase in serum GH  $6.919 \pm 4.607$  ng/ml than the exercised castrated group  $5.031 \pm 2.680$  ng/ml ( $P > 0.05$ ) and the serum GH is still below the control group  $8.321 \pm 2.521$ . Serum levels of PRL in control and castrated rats are compared with the corresponding values in exercised castrated half dose testosterone replaced rats as shown in table (14) and figure (14). It is clear that half dose testosterone replacement in exercised

castrated rats resulted in insignificant increase in serum PRL  $5.238 \pm 2.071$  ng/ml compared with the control and the castrated groups  $4.131 \pm 2.120$  ng/ml ( $P > 0.05$ ) and  $3.925 \pm 1.614$  ng/ml.

***Table (1): Comparison between serum GH in control and castrated groups ng/ml***

<b>NO</b>	<b>GH level in control group</b>	<b>GH level in castrated group</b>
1	7.1300	3.3800
2	6.9800	5.1200
3	8.0100	3.6500
4	9.1200	2.9800
5	4.5200	5.4600
6	13.0400	6.0100
7	7.6200	3.3200
8	10.1500	2.8900
Mean	8.321	4.101
SD	±2.521	±1.230
P value		<0.05



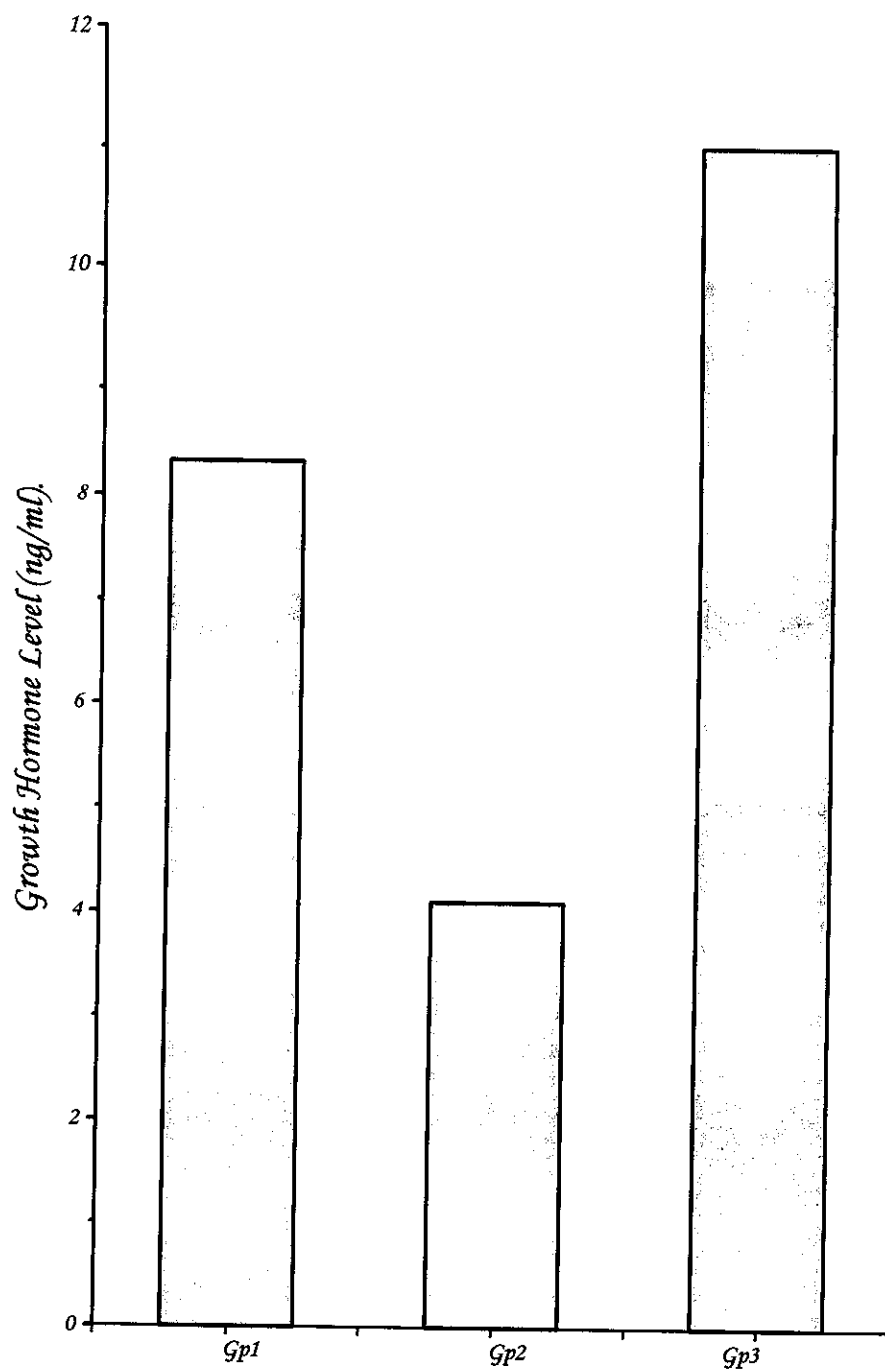


**Table (2): Comparison between serum GH in control, castrated and exercised sham castrated ng/ml**

NO	GH level in control group	GH level in castrated group	GH level in exercised sham castrated group
1	7.1300	3.3800	5.8700
2	6.9800	5.1200	13.2500
3	8.0100	3.6500	11.6700
4	9.1200	2.9800	15.1400
5	4.5200	5.4600	6.8700
6	13.0400	6.0100	14.1900
7	7.6200	3.3200	13.8900
8	10.1500	2.8900	7.2400
Mean	8.321	4.101	11.020
SD	±2.521	±1.230	±3.755
P value			*<0.05 **<0.05

**\* Compared with control group**

**\*\* Compared with castrated group**



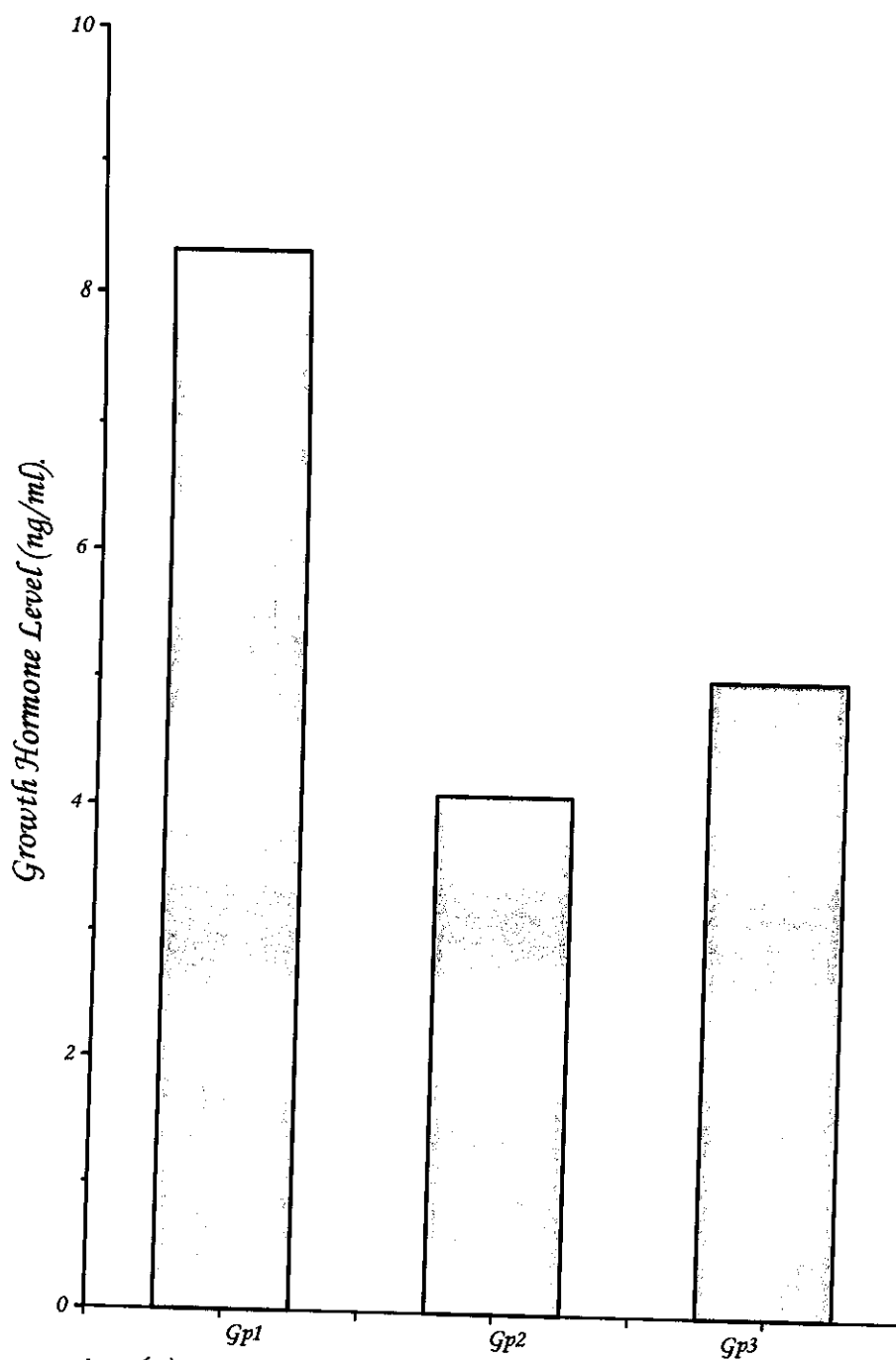
*Fig. (2): Comparison between serum GH in control, castrated and exercised sham castrated groups (ng/ml).*

**Table (3): Comparison between serum GH in control, castrated and exercised castrated group's ng/ml**

NO	GH level in control group	GH level in castrated group	GH level in exercised castrated group
1	7.1300	3.3800	3.1500
2	6.9800	5.1200	7.9400
3	8.0100	3.6500	1.8400
4	9.1200	2.9800	3.8700
5	4.5200	5.4600	7.0100
6	13.0400	6.0100	4.8000
7	7.6200	3.3200	2.5400
8	10.1500	2.8900	9.1000
Mean	8.321	4.101	5.031
SD	±2.521	±1.230	±2.680
P value			*NS **NS

**\* Compared with control group**

**\*\* Compared with castrated group**



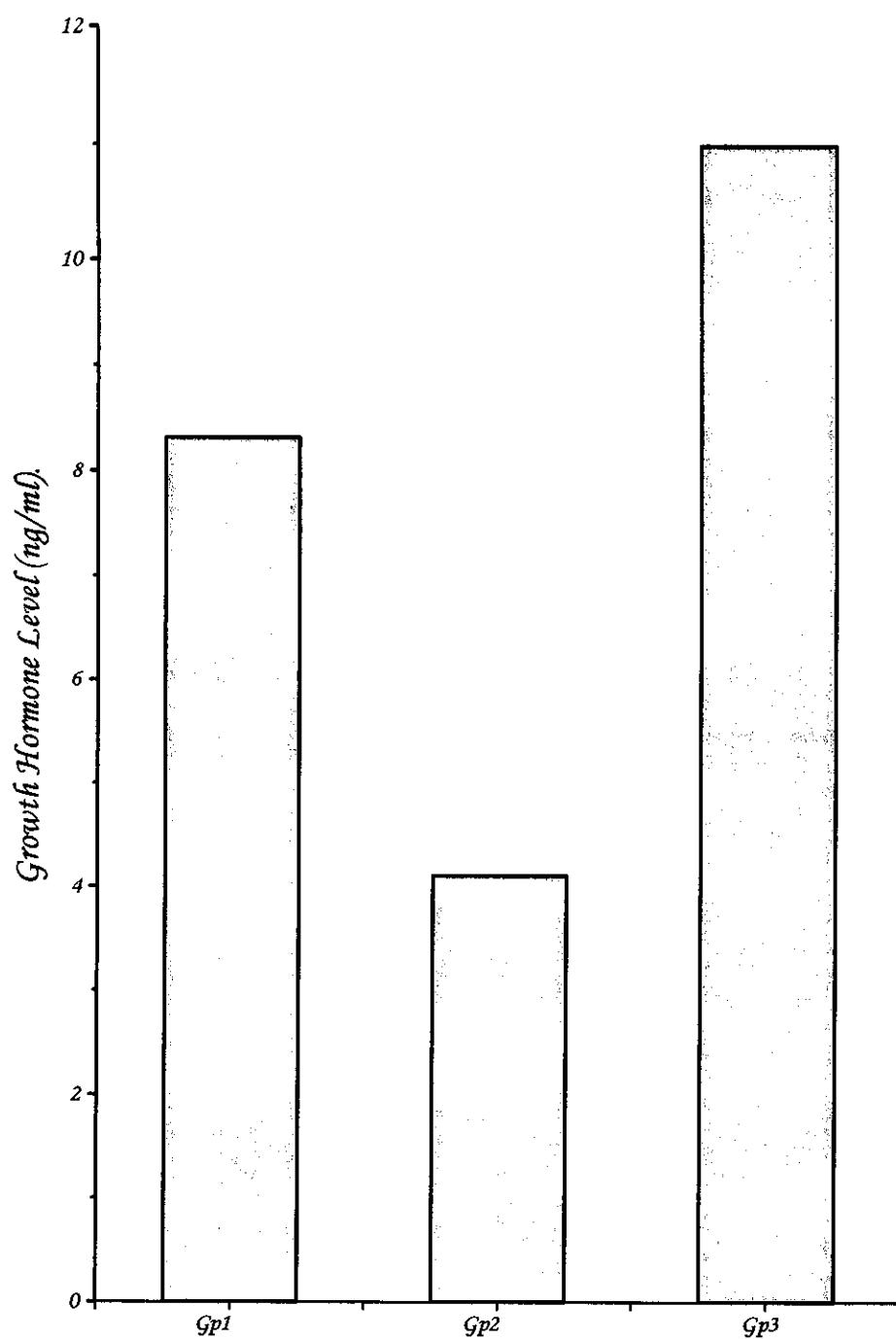
*Fig. (3): Comparison between serum GH in control. castrated and exercised castrated group's (ng/ml).*

**Table (4): Comparison between serum GH in control, castrated, and exercised castrated testosterone replaced groups ng/ml**

NO	GH level in control group	GH level in castrated group	GH level in exercised castrated testosterone replaced group
1	7.1300	3.3800	14.1200
2	6.9800	5.1200	7.2500
3	8.0100	3.6500	9.9800
4	9.1200	2.9800	10.8400
5	4.5200	5.4600	17.0800
6	13.0400	6.0100	6.9100
7	7.6200	3.3200	12.7000
8	10.1500	2.8900	8.9700
Mean	8.321	4.101	10.98
SD	±2.521	±1.230	±3.496
P value			*NS **<0.05

\* *Compaired with control group.*

\*\* *Compaired with castrated group.*



*Fig. (4): Comparison between serum GH in control, castrated and exercised castrated testosterone replaced groups (ng/ml).*

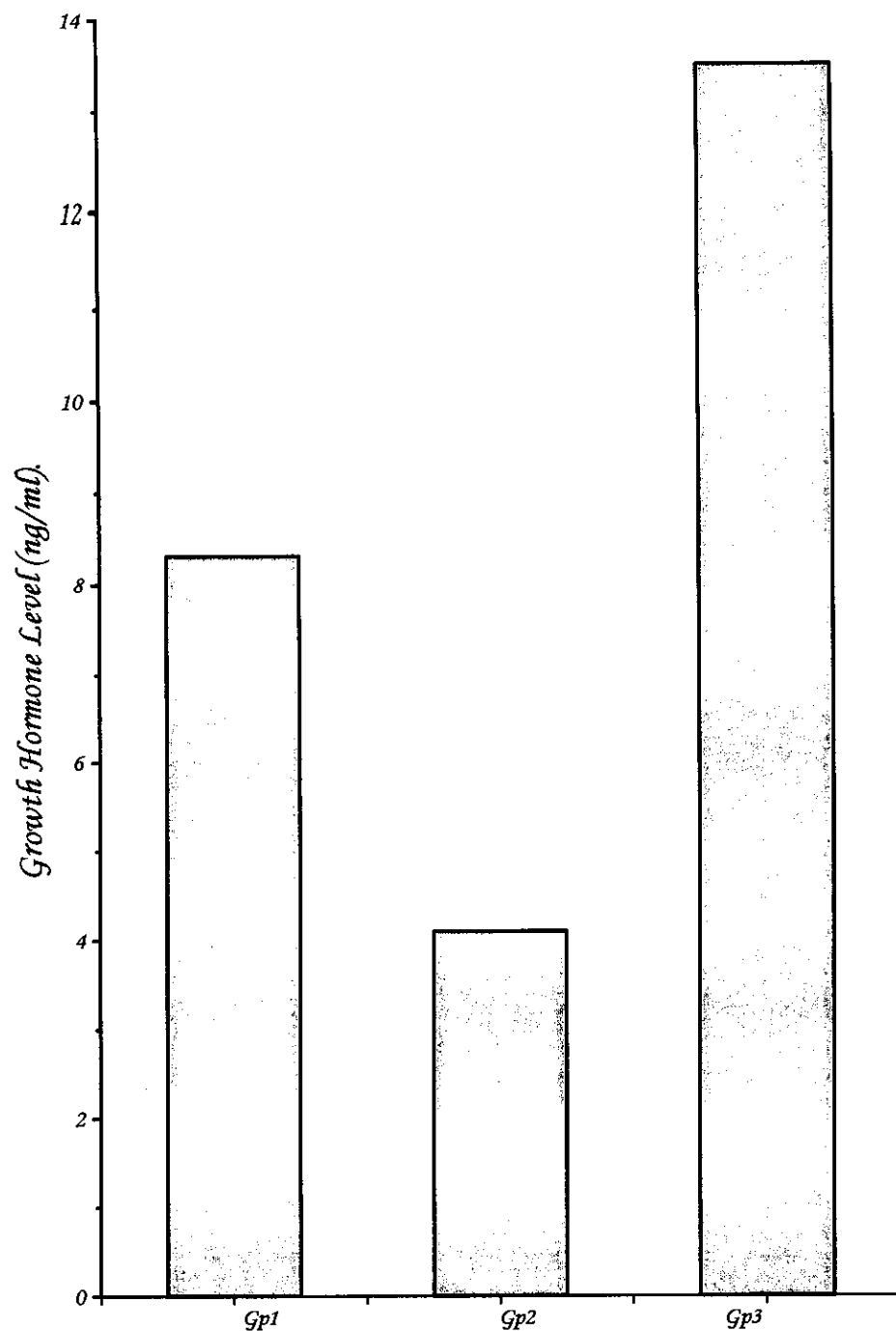
**Table (5): Comparison between serum GH in control, castrated and exercised castrated double dose testosterone replaced groups ng/ml**

NO	GH level in control group	GH level in castrated group	GH level in exercised castrated double dose testosterone replaced group
1	7.1300	3.3800	15.1200
2	6.9800	5.1200	8.5400
3	8.0100	3.6500	11.8700
4	9.1200	2.9800	18.8000
5	4.5200	5.4600	6.0100
6	13.0400	6.0100	14.8700
7	7.6200	3.3200	15.9800
8	10.1500	2.8900	16.7800
Mean	8.321	4.101	13.50
SD	±2.521	±1.230	±4.357
P value			*<0.01 **<0.001

*\* Compared with control group.*

*\*\* Compared with castrated group.*





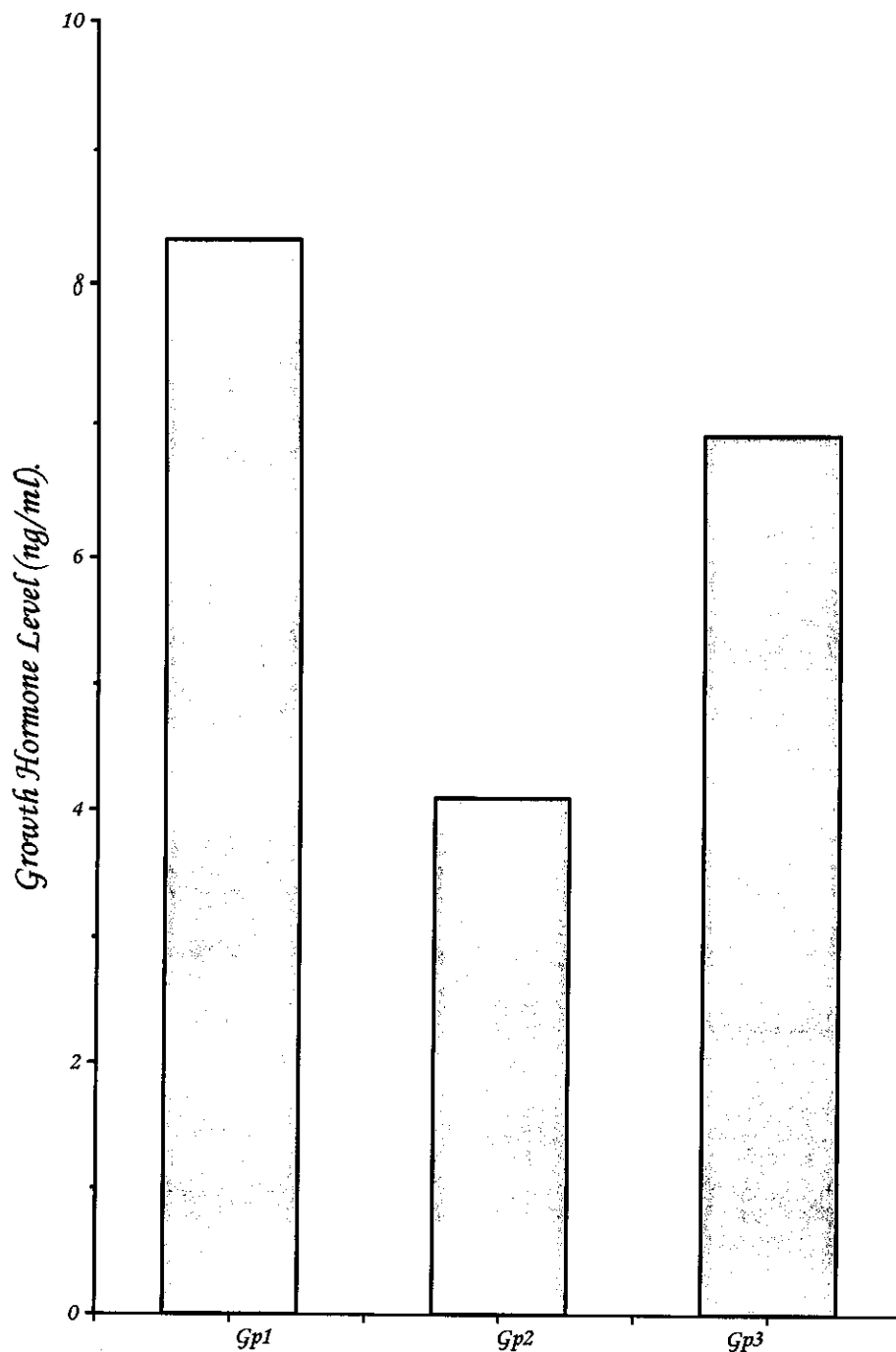
*Fig. (5): Comparison between serum GH in control, castrated and exercised castrated double dose testosterone replaced groups (ng/ml).*

**Table (6): Comparison between serum GH in control, castrated and exercised castrated half dose testosterone replaced groups ng/ml**

NO	GH level in control group	GH level in castrated group	GH level in exercised castrated half dose testosterone replaced group
1	7.1300	3.3800	3.5000
2	6.9800	5.1200	4.3000
3	8.0100	3.6500	12.4500
4	9.1200	2.9800	7.4600
5	4.5200	5.4600	2.5200
6	13.0400	6.0100	10.2800
7	7.6200	3.3200	13.2500
8	10.1500	2.8900	1.5900
Mean	8.321	4.101	6.919
SD	±2.521	±1.230	±4.607
P value			*NS **<0.05

*\* Compared with control group.*

*\*\* Compared with castrated group.*



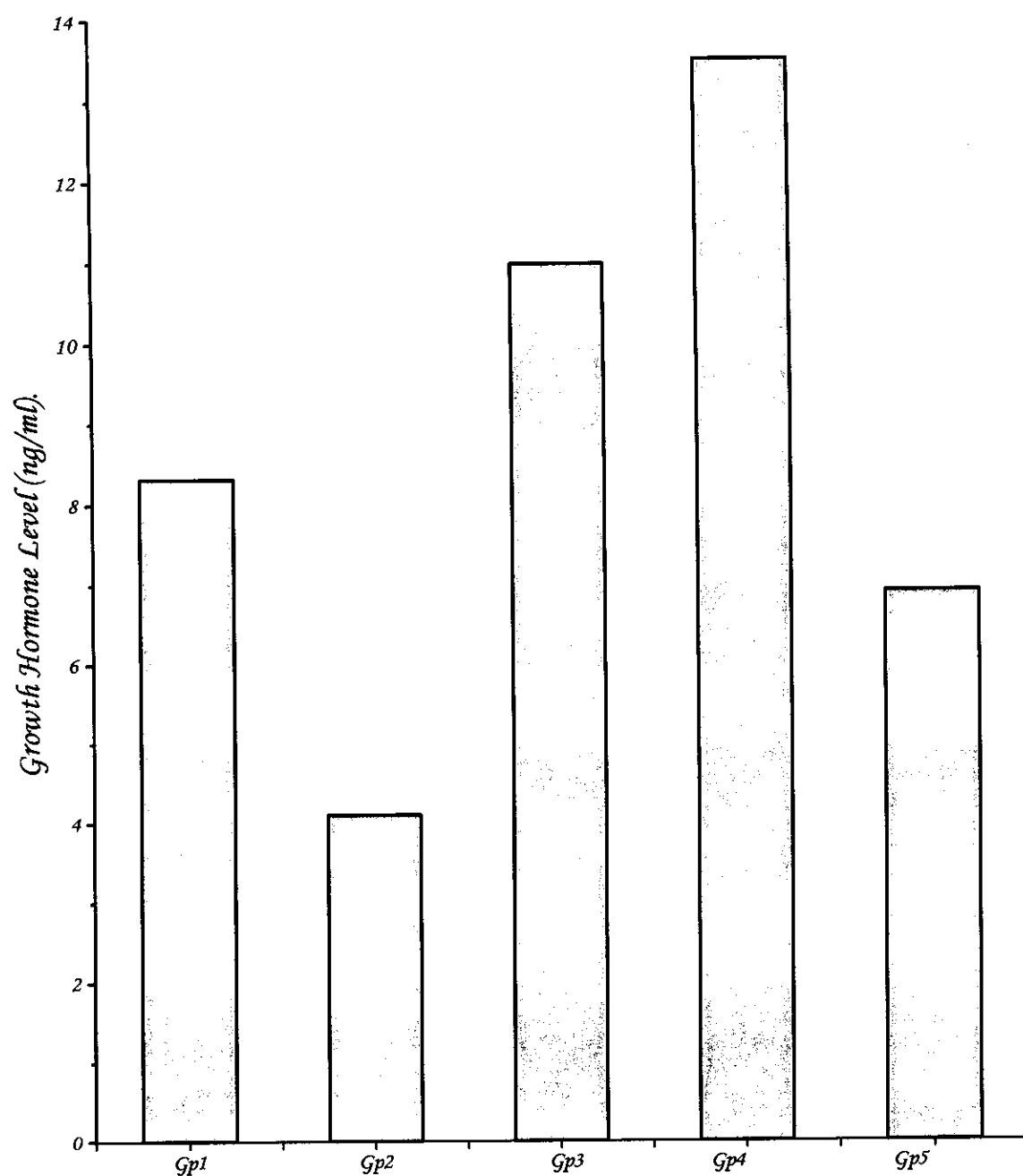
*Fig. (6): Comparison between serum GH in control castrated and exercised castrated half dose testosterone replaced groups (ng/mL).*

**Table (7): Comparison between serum GH in control, castrated and testosterone replaced groups by different doses ng/ml**

No	GH level in control group	GH level in castrated group	Ex & Cast Test.	Ex & Cast Double-test.	Ex & Cast Half-test.
1	7.1300	3.3800	14.1200	15.1200	3.5000
2	6.9800	5.1200	7.2500	8.5400	4.3000
3	8.0100	3.6500	9.9800	11.8700	12.4500
4	9.1200	2.9800	10.8400	18.8000	7.4600
5	4.5200	5.4600	17.0800	6.0100	2.5200
6	13.0400	6.0100	6.9100	14.8700	10.2800
7	7.6200	3.3200	12.7000	15.9800	13.2500
8	10.1500	2.8900	8.9700	16.7800	1.5900
Mean	8.321	4.101	10.98	13.50	6.919
SD	± 2.521	± 1.230	± 3.496	± 4.357	± 4.607
P Value			*NS **<0.05	*<0.01 **<0.001	*NS **<0.05

*\* Compared with control group.*

*\*\* Compared with castrated group.*



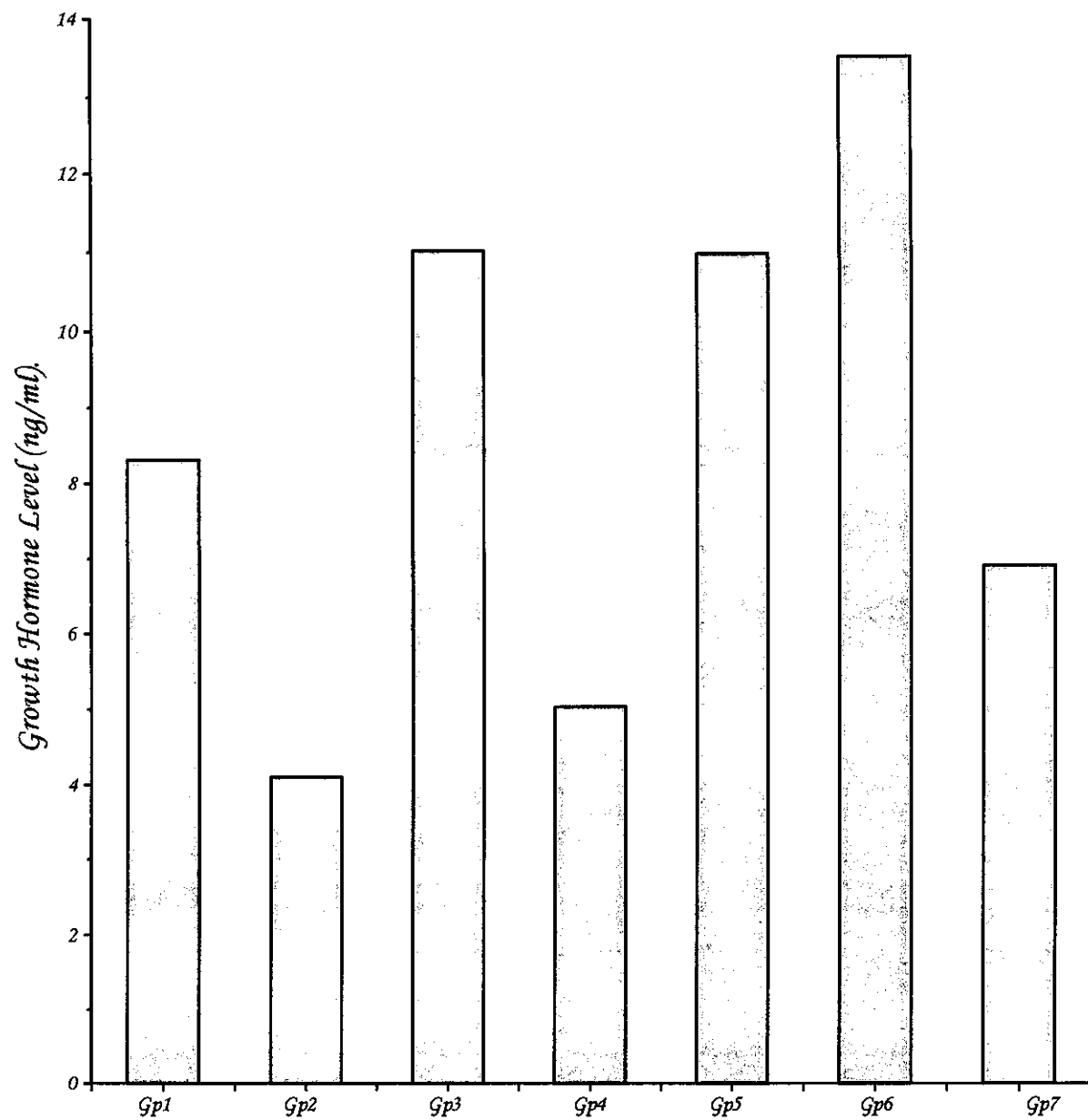
*Fig. (7): Comparison between serum GH in control, castrated and testosterone replaced groups by different doses (ng/ml).*

**Table (8): Comparison between serum GH in control, castrated and different groups ng/ml**

No	Control	Castration	Exercise	Ex & Cast	Ex & Cast Test.	Ex & Cast Double-test.	Ex & Cast Half-test.
1	7.1300	3.3800	5.8700	3.1500	14.1200	15.1200	3.5000
2	6.9800	5.1200	13.2500	7.9400	7.2500	8.5400	4.3000
3	8.0100	3.6500	11.6700	1.8400	9.9800	11.8700	12.4500
4	9.1200	2.9800	15.1400	3.8700	10.8400	18.8000	7.4600
5	4.5200	5.4600	6.8700	7.0100	17.0800	6.0100	2.5200
6	13.0400	6.0100	14.1900	4.8000	6.9100	14.8700	10.2800
7	7.6200	3.3200	13.8900	2.5400	12.7000	15.9800	13.2500
8	10.1500	2.8900	7.2400	9.1000	8.9700	16.7800	1.5900
Mean	8.321	4.101	11.020	5.031	10.98	13.500	6.919
SD	±2.521	±1.230	±3.755	±2.680	±3.496	±4.357	±4.607
P Value			*<0.05 **<0.05	*NS **NS	*NS **<0.05	*<0.01 **<0.01	*NS **<0.05

**\* Compared with control group.**

**\*\* Compared with castrated group.**



*Fig (8): Comparison between serum GH in control, castrated and different groups (ng/ml).*

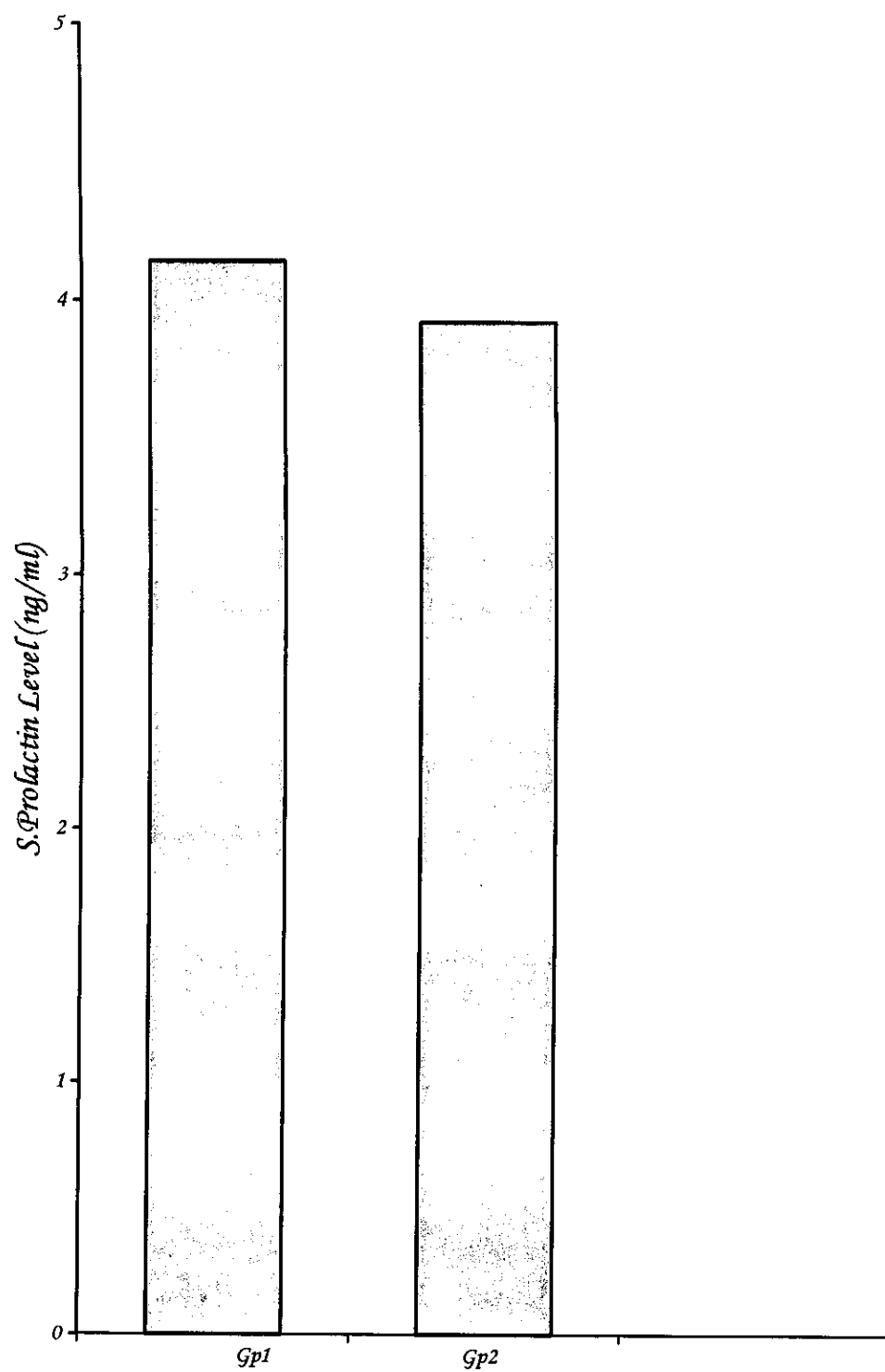
**Table (9): Comparison between serum PRL in control and castrated groups ng/ml**

<b>NO</b>	<b>PRL level in control group</b>	<b>PRL level in castrated group</b>
1	4.510	6.120
2	6.410	2.640
3	2.260	1.840
4	5.140	6.130
5	7.010	3.590
6	2.060	4.280
7	4.510	2.460
8	1.150	4.340
Mean	4.131	3.925
SD	±2.120	±1.614
P value		NS

**\* Compared with control group.**

**\*\* Compared with castrated group.**





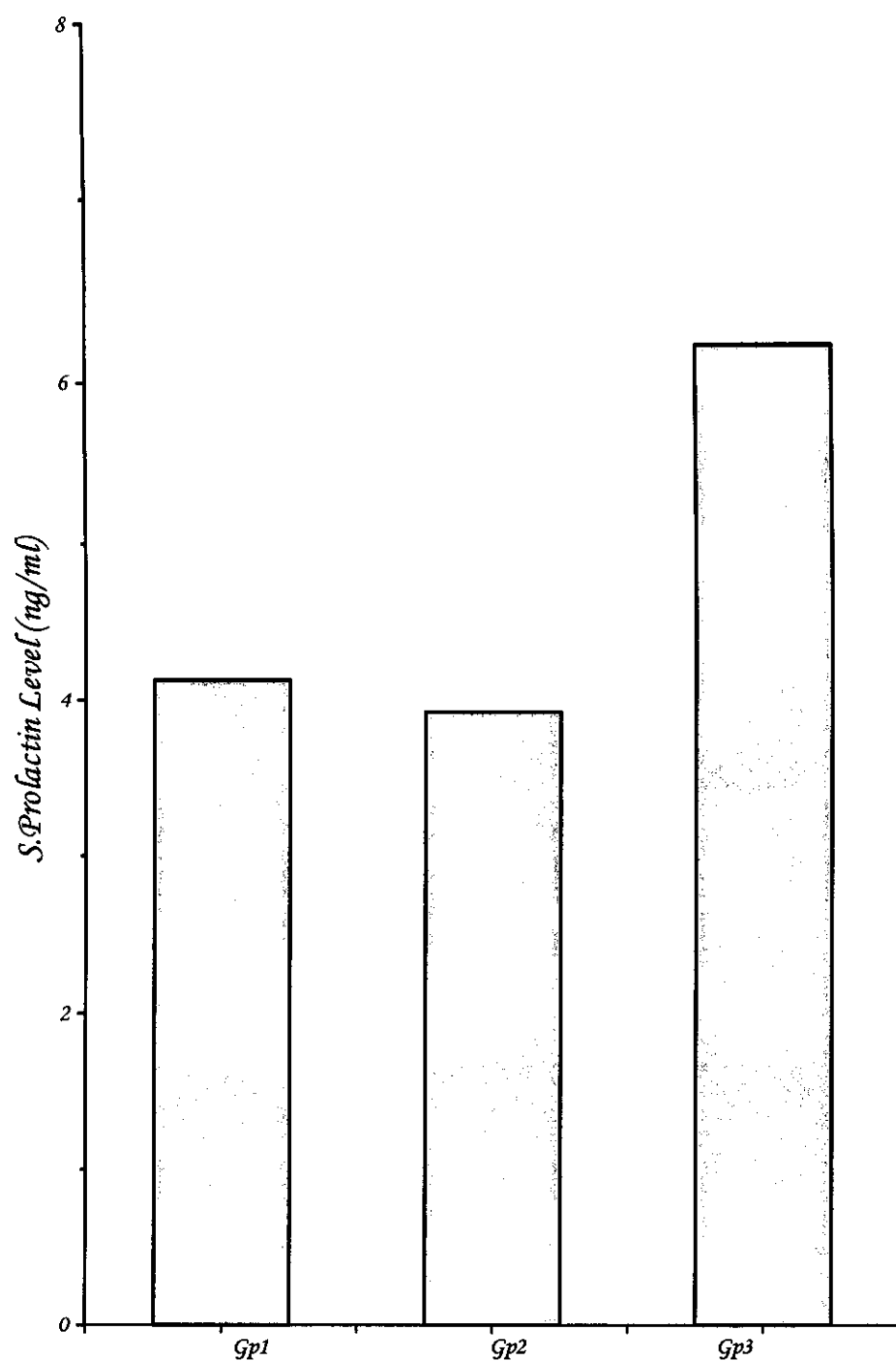
*Fig. (9): Comparison between serum PRL in control and castrated groups (ng/ml).*

**Table (10): Comparison between serum PRL in control castrated and exercised sham castrated groups ng/ml**

<b>NO</b>	<b>PRL level in control group</b>	<b>PRL level in castrated group</b>	<b>PRL level in exercised sham castrated group</b>
1	4.510	6.120	3.460
2	6.410	2.640	10.610
3	2.260	1.840	6.210
4	5.140	6.130	5.940
5	7.010	3.590	6.730
6	2.060	4.280	4.810
7	4.510	2.460	5.530
8	1.150	4.340	6.420
Mean	4.131	3.925	6.214
SD	±2.120	±1.614	±2.061
P value			*<0.05 **NS

**\* Compared with control group.**

**\*\* Compared with castrated group.**



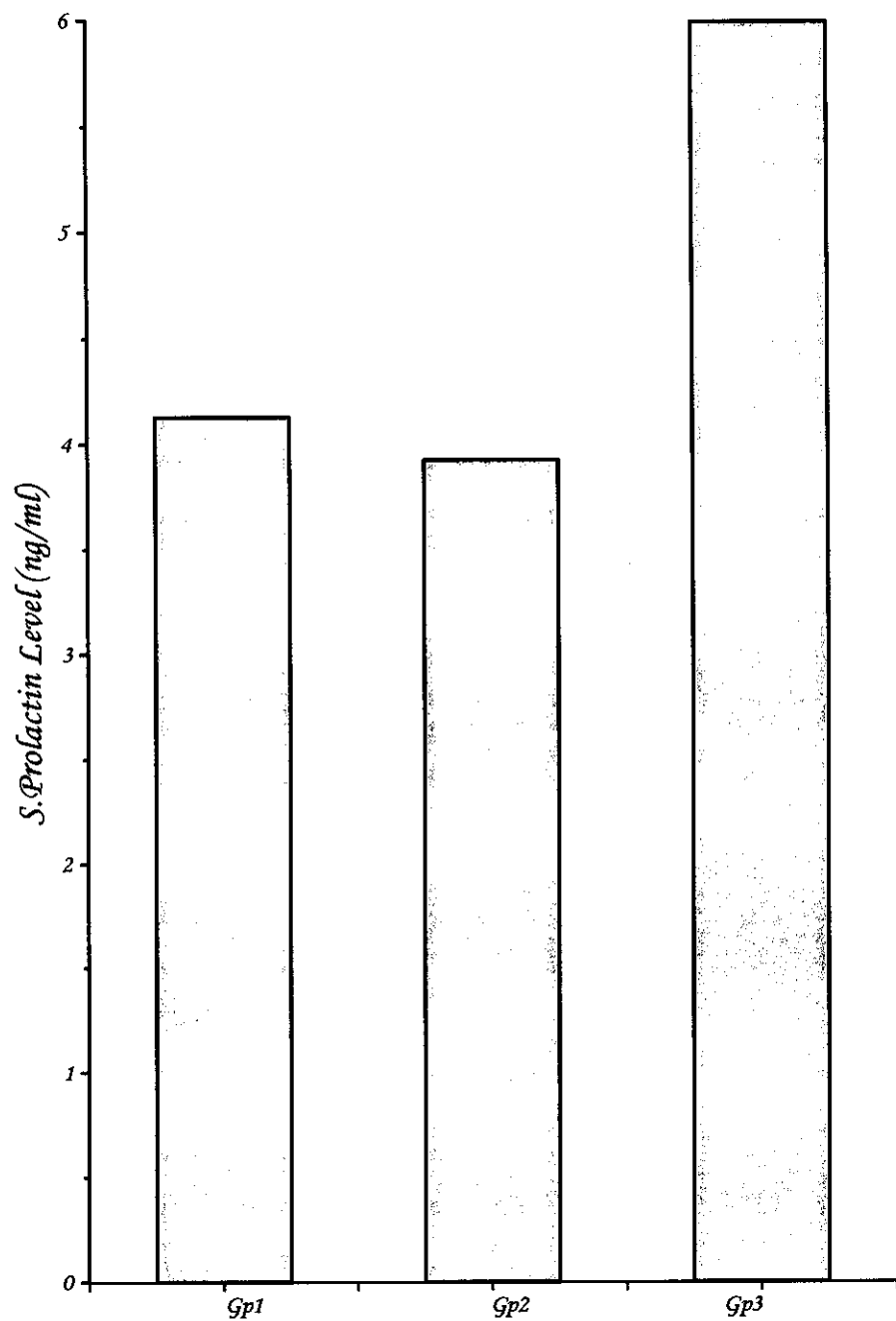
*Fig. (10): Comparison between serum PRL in control castrated and exercised sham castrated groups (ng/ml)*

**Table (11): Comparison between serum PRL in control, castrated and exercised castrated groups ng/ml**

<b>NO</b>	<b>PRL level in control group</b>	<b>PRL level in castrated group</b>	<b>PRL level in exercised castrated group</b>
1	4.510	6.120	4.910
2	6.410	2.640	6.260
3	2.260	1.840	5.750
4	5.140	6.130	9.050
5	7.010	3.590	7.630
6	2.060	4.280	4.830
7	4.510	2.460	3.640
8	1.150	4.340	5.820
Mean	4.131	3.925	5.986
SD	±2.120	±1.614	±1.701
P value			*<0.05 **<0.05

**\* Compaired with control group.**

**\*\* Compaired with castrated group.**



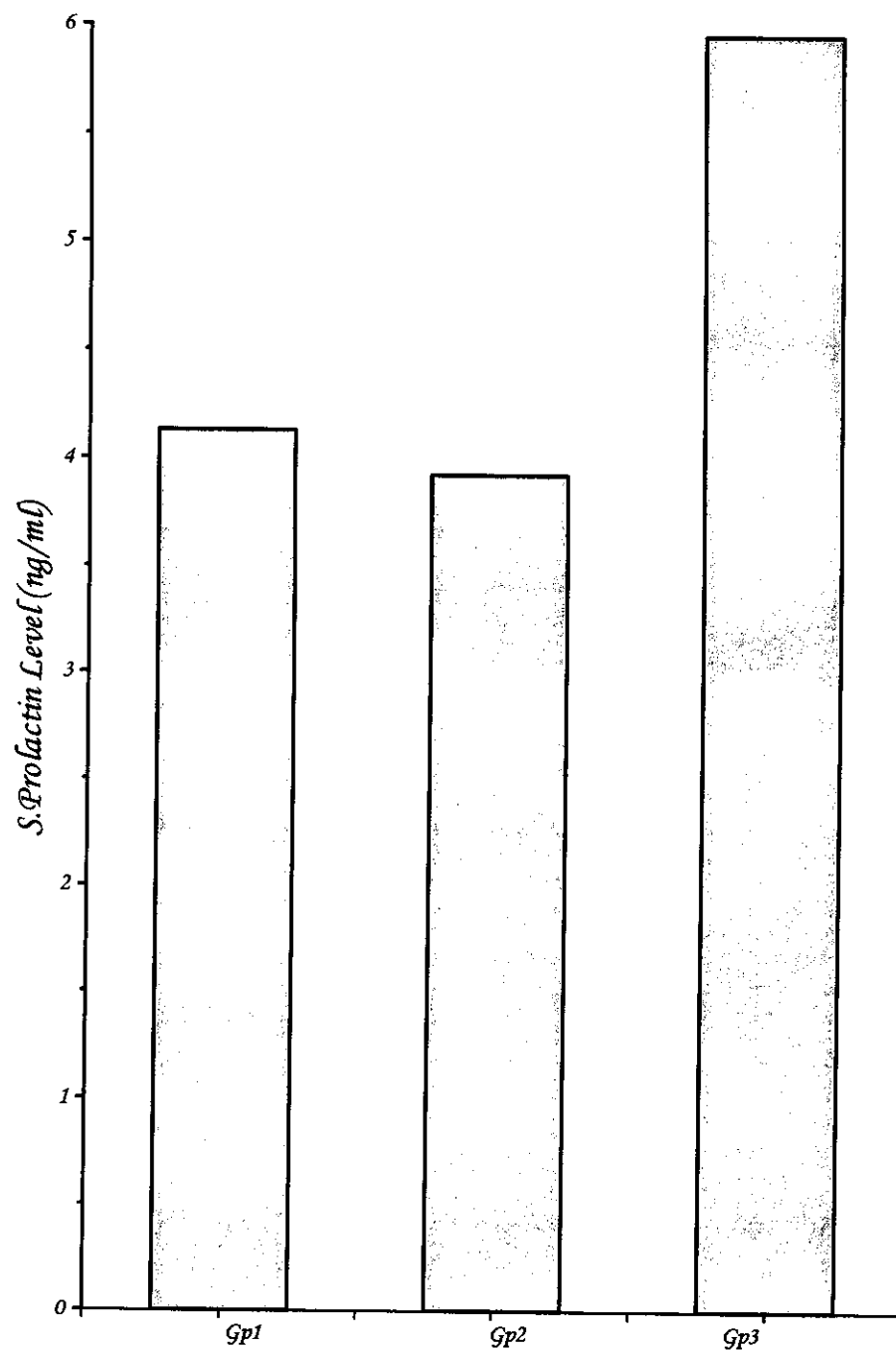
*Fig. (11): Comparison between serum PRL in control, castrated and exercised castrated groups ng/ml*

**Table (12): Comparison between serum PRL in control, castrated and exercise castrated testosterone replaced groups ng/ml**

<b>NO</b>	<b>PRL level in control group</b>	<b>PRL level in castrated group</b>	<b>PRL level in exercised castrated testosterone replaced group</b>
1	4.510	6.120	7.110
2	6.410	2.640	4.570
3	2.260	1.840	2.920
4	5.140	6.130	7.280
5	7.010	3.590	8.630
6	2.060	4.280	5.390
7	4.510	2.460	7.650
8	1.150	4.340	4.020
Mean	4.131	3.925	5.946
SD	±2.120	±1.614	±2.011
P value			*NS **NS

**\* Compaired with control group.**

**\*\* Compaired with castrated group.**



*Fig. (12): Comparison between serum PRL in control, castrated and exercise castrated testosterone replaced groups (ng/ml)*

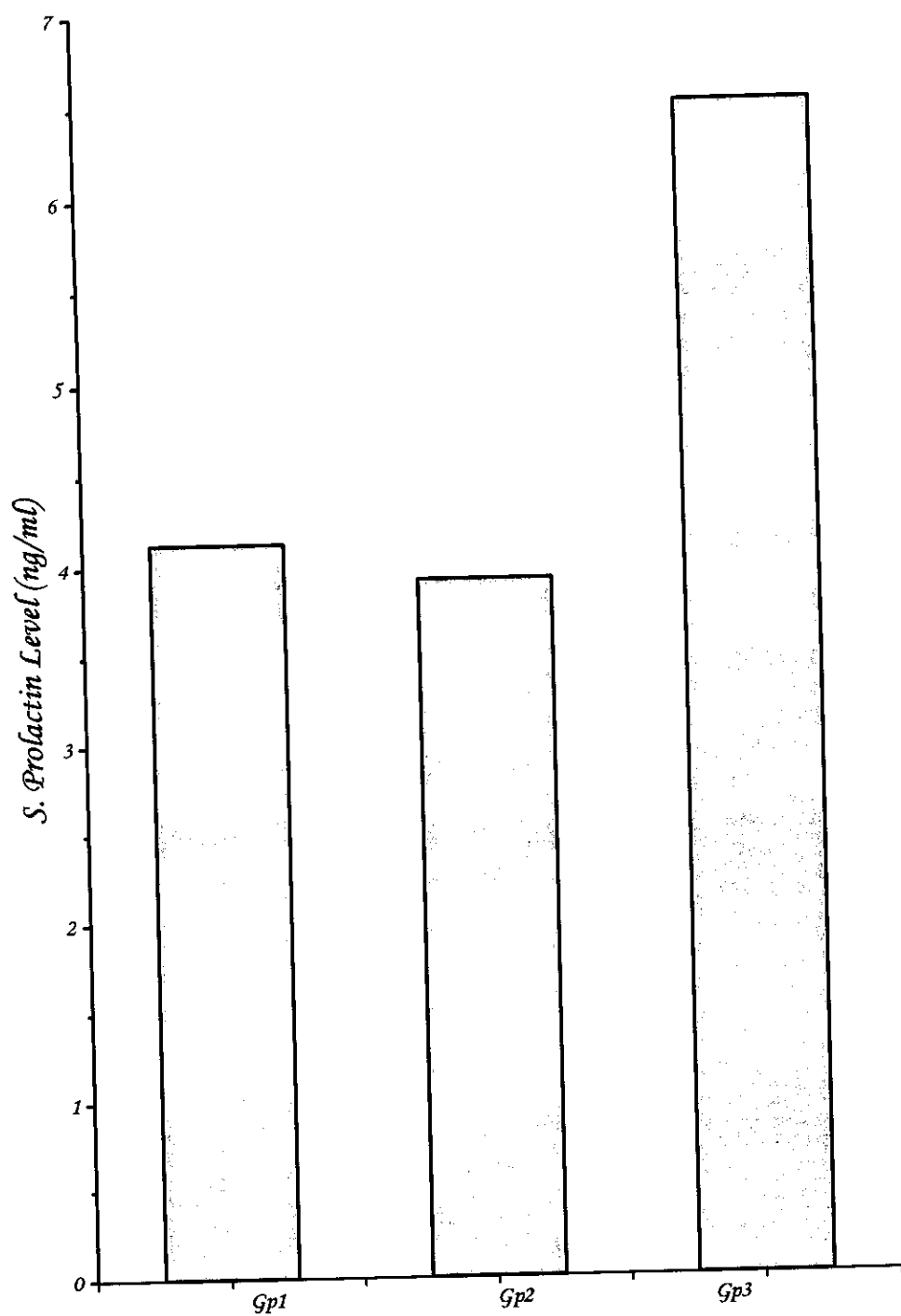
**Table (13): Comparison between serum PRL in control, castrated and exercised castrated double dose testosterone replaced groups ng/ml**

<b>NO</b>	<b>GH level in control group</b>	<b>PRL level in castrated group</b>	<b>PRL level in exercised castrated double dose testosterone replaced group</b>
1	4.510	6.120	3.810
2	6.410	2.640	5.340
3	2.260	1.840	9.260
4	5.140	6.130	2.750
5	7.010	3.590	11.120
6	2.060	4.280	4.080
7	4.510	2.460	10.350
8	1.150	4.340	5.380
Mean	4.131	3.925	6.511
SD	±2.120	±1.614	±3.241
P value			*<0.05 **<0.05

**\* Compared with control group.**

**\*\* Compared with castrated group.**





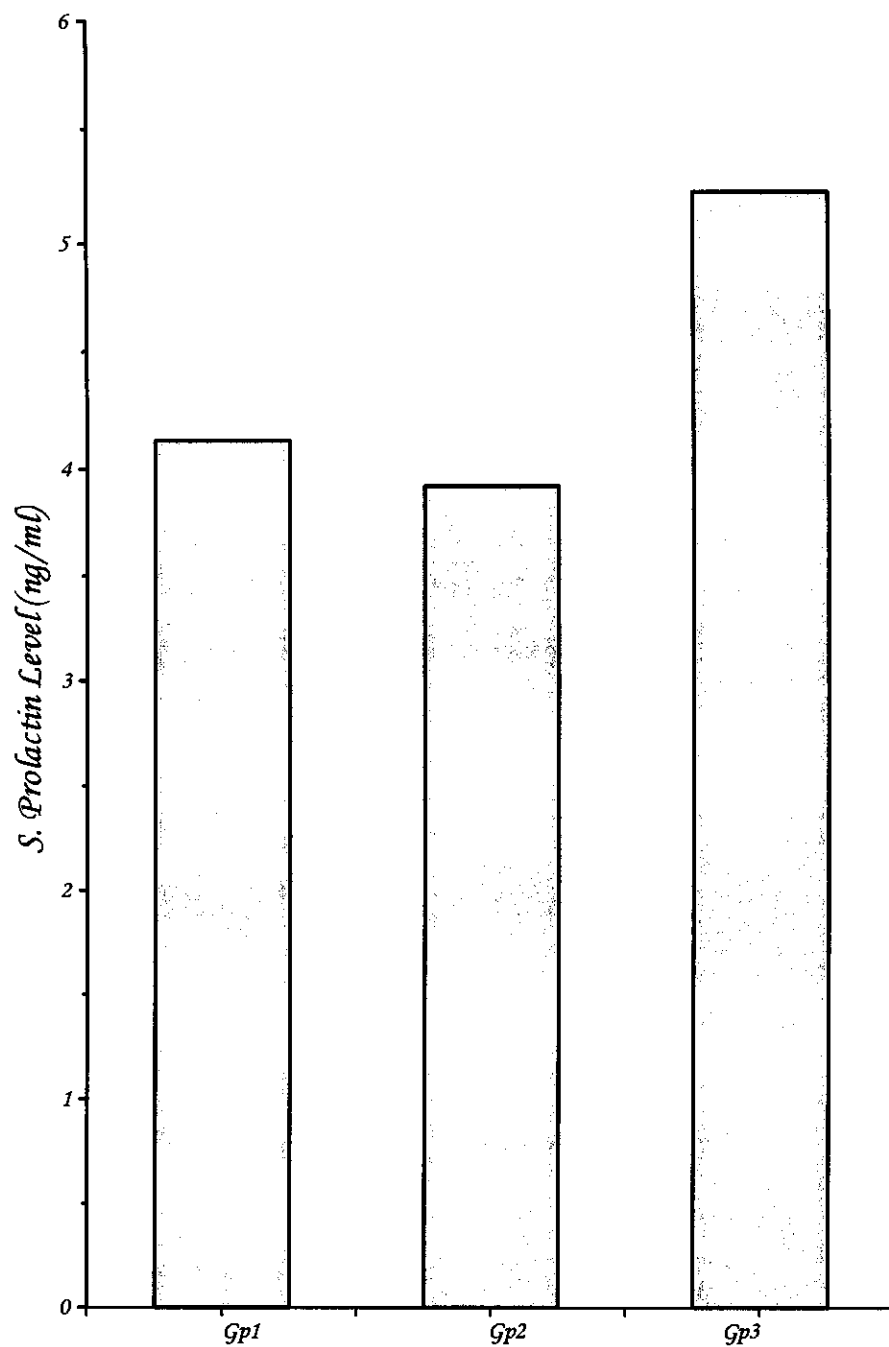
*Fig. (13): Comparison between serum PRL in control, castrated and exercised castrated double dose testosterone replaced groups (ng/ml)*

**Table (14): Comparison between serum PRL in control, castrated and exercised castrated half dose testosterone replaced groups ng/ml**

<b>NO</b>	<b>GH level in control group</b>	<b>PRL level in castrated group</b>	<b>PRL level in exercised castrated half dose testosterone replaced group</b>
1	4.510	6.120	6.240
2	6.410	2.640	9.160
3	2.260	1.840	3.840
4	5.140	6.130	1.930
5	7.010	3.590	5.460
6	2.060	4.280	4.830
7	4.510	2.460	5.730
8	1.150	4.340	4.710
Mean	4.131	3.925	5.238
SD	±2.120	±1.614	±2.071
P value			*NS **NS

**\* Compared with control group.**

**\*\* Compared with castrated group.**



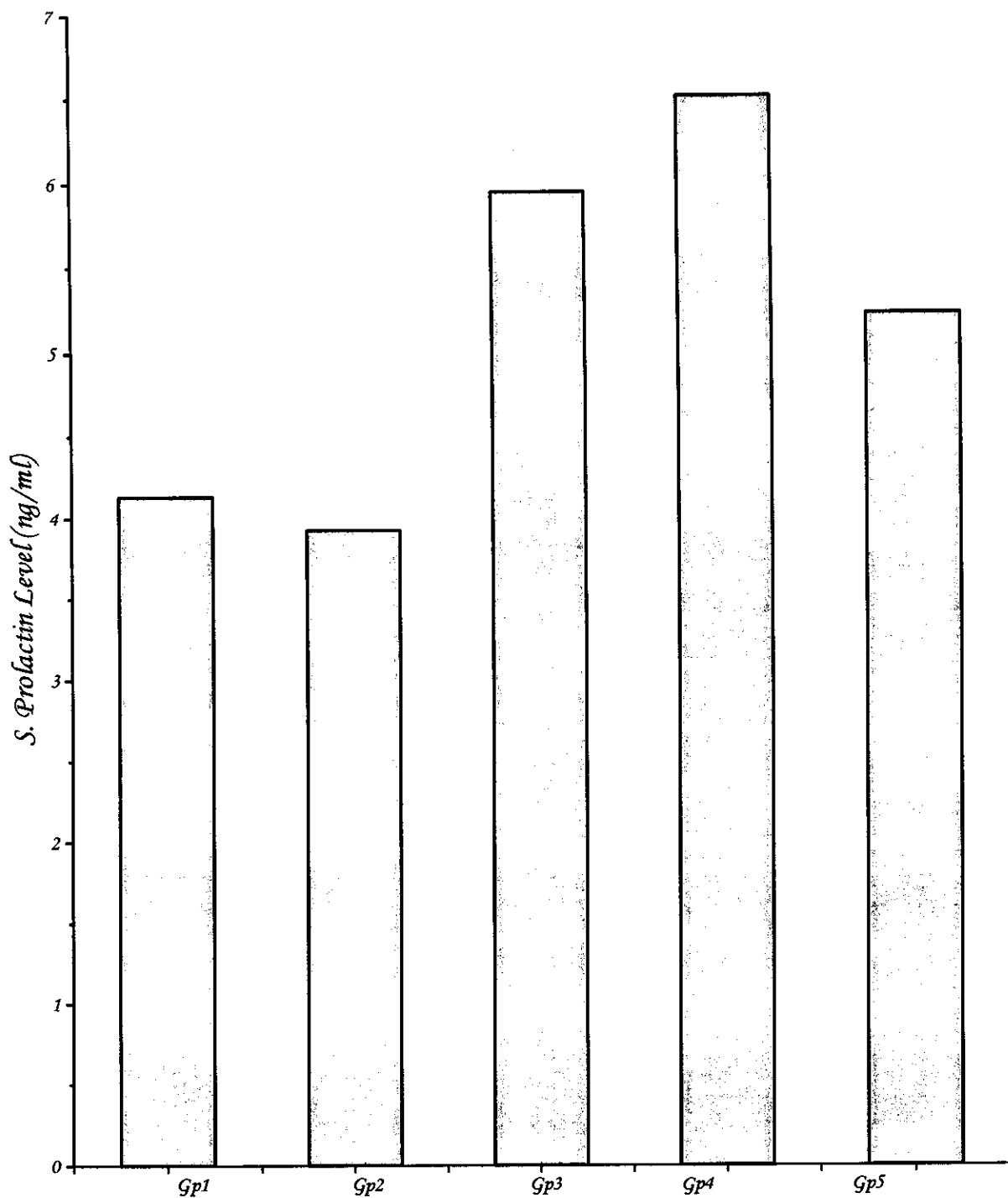
*Fig. (14): Comparison between serum PRL in control, castrated and exercised castrated half dose testosterone replaced groups (ng/ml).*

**Table (15): Comparison between serum PRL in control castrated and exercised castrated testosterone replaced groups ng/ml**

<b>NO</b>	<b>PRL level in control group</b>	<b>PRL level in castrated group</b>	<b>Ex &amp; Cast Test.</b>	<b>Ex &amp; Cast Double-test.</b>	<b>Ex &amp; Cast Half-test.</b>
1	4.510	6.120	7.110	3.810	6.240
2	6.410	2.640	4.570	5.340	9.160
3	2.260	1.840	2.920	9.260	3.840
4	5.140	6.130	7.280	2.750	1.930
5	7.010	3.590	8.630	11.120	5.460
6	2.060	4.280	5.390	4.080	4.830
7	4.510	2.460	7.650	10.350	5.730
8	1.150	4.340	4.020	5.380	4.710
Mean	4.131	3.925	5.946	6.511	5.238
SD			*NS **NS	*<0.05 **<0.05	*NS **NS
P value	±2.120	±1.614	±2.011	±3.241	±2.071

*\* Compared with control group.*

*\*\* Compared with castrated group.*



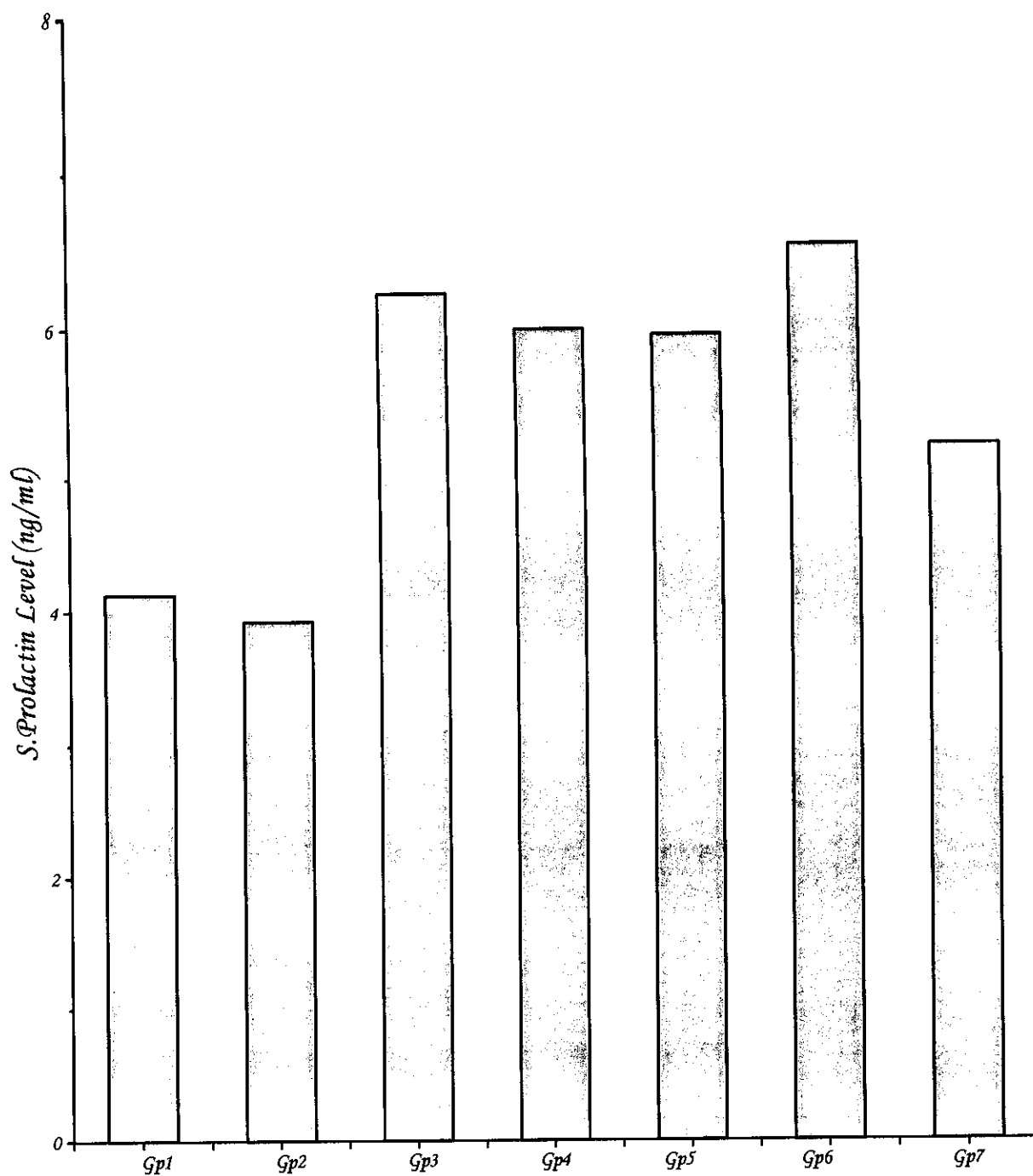
*Fig. (15): Comparison between serum PRL in control castrated and exercised castrated testosterone replaced groups (ng/ml).*

**Table (16): Comparison between serum PRL in control, castrated and different groups ng/ml**

<i>No</i>	<i>Control</i>	<i>Castration</i>	<i>Exercise</i>	<i>Ex &amp; Cast</i>	<i>Ex &amp; Cast Test.</i>	<i>Ex &amp; Cast Double-test.</i>	<i>Ex &amp; Cast Half-test.</i>
1	4.510	6.120	3.460	4.910	7.110	3.810	6.240
2	6.410	2.640	10.610	6.260	4.570	5.340	9.160
3	2.260	1.840	6.210	5.750	2.920	9.260	3.840
4	5.140	6.130	5.940	9.050	7.280	2.750	1.930
5	7.010	3.590	6.730	7.630	8.630	11.120	5.460
6	2.060	4.280	4.810	4.830	5.390	4.080	4.830
7	4.510	2.460	5.530	3.640	7.650	10.350	5.730
8	1.150	4.340	6.420	5.820	4.020	5.380	4.710
Mean	4.131	3.925	6.214	5.986	5.946	6.511	5.238
SD	±2.120	±1.614	±2.061	±1.701	±2.011	±3.241	±2.071
P Value			*<0.05 **NS	*<0.05 **<0.05	*NS **NS	*<0.05 **<0.05	*NS **NS

*\* Compared with control group.*

*\*\* Compared with castrated group.*



*Fig. (16): Comparison between serum PRL in control, castrated and different groups (ng/ml)*