RESULTS

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This study has been carried out on male rats to investigate the role of opioid receptors in the feedback control of gonadotropins by testosterone. Investigation of the opioid receptors was done by their stimulation by an opiate agonist, morphine, and their blockage by an opiate antagonist naloxone, both in castrated rats and in rats castrated and replaced with testosterone. Seven groups of rats were used, each included six animals. Serum testosterone and LH levels were measured in all rats. The results are shown in the following :-

Group (1): Control rats :-

The results are shown in table (1) and figure (1). It can be seen that serum testosterone levels in this group ranged between 1.86 and 4.19 ng/ml, with a mean value of 3.25 $\pm$ 0.9 ng/ml. The serum LH levels ranged between 1.8 and 4.67 miu/ml, with a mean value of 2.73 $\pm$ 1.1 miu/ml.

Group (2): Rats castrated for one week :

Results are shown in table (2) and fig. (2). In this group the serum testosterone levels ranged between 0.32 and 1.7 ng/ml with a mean value of 1.04 $\pm$ 0.6 ng/ml.

Serum LH levels ranged between 12.59 and 20.96 miu/ml, with a mean value of 16.4 ± 3.0 miu/ml.

Serum levels of testosterone and L.H. in control ratrs are compared with the corresponding values in castrated rats (table 3 and fig. 3). It is clear that castration resulted in a significant decrease in serum testosterone from 3.25 ± 0.9 ng/ml in control group to 1.04 ± 0.6 ng/ml in castrated group ($P<0.01$), while serum L.H. significantly increased from 2.73 ± 1.1 miu/ml in control group to 16.4 ± 3.0 miu/ml in castrated group ($P<0.001$).

Group (3) : Rats castrated for one week and injected S.C. with morphine sulphate 10 mg/kg :-

Results are shown in table (4) and fig. (4). Serum testosterone levels in this group ranged between 0.72 and 2.15 ng/ml, with a mean value of 1.27 ± 0.5 ng/ml. Serum L.H. levels ranged between 6.83 and 11.16 miu/ml with a mean value of 8.8 ± 1.7 miu/ml.

Table (5) and fig. (5) serum testosterone and L.H. levels in rats castrated with morphine injection with those levels in control rats. It was found that testosterone significantly decreased from 3.25 ± 0.9 ng/ml in control rats to 1.27 ± 0.5 ng/ml in castrated and morphine-injected

group ($P<0.01$). On the other hand serum L.H. significantly increased from 2.73 $\pm$ 1.1 miu/ml to 8.8 $\pm$ 1.7 miu/ml in the same groups respectively ($P<0.005$).

Table (6) and fig. (6) compare the two hormones in rats castrated and injected with morphine and those in rats castrated only. Serum testosterone showed no significant change in the two groups, but serum L.H. significantly decreased from 16.4 $\pm$ 3.0 miu/ml in the castrated group to 8.8 $\pm$ 1.7 miu/ml in castrated and morphine-injected group ($P<0.01$).

These results suggest that stimulation of the opioid receptors probably plays a role in the feedback inhibition of L.H. release by testosterone.

Group (4) : Rats castrated for one week and injectged S.C. with naloxone HCl, 1 mg/kg:

Results are shown in table (7) and fig. (7). Serum testosterone levels in this group ranged between 0.37 and 3.06 ng/ml with a mean value of 1.43 $\pm$ 1.1 ng/ml. Serum L.H. levels ranged between 12.63 and 24.84 miu/ml with a mean value of 19.28 $\pm$ 4.3 miu/ml.

Table (8) and fig. (8) compare between the levels of the two hormones in this group and in the control group.

It can be seen that testosterone significantly decreased from 3.25 ± 0.9 ng/ml in control rats to 1.43 ± 1.1 ng/ml in castrated and naloxone-injected rats ($P<0.05$), while serum L.H. increased significantly in the same groups from 2.73 ± 1.1 to 19.28 ± 4.3 miu/ml respectively ($P<0.001$).

Table (9) and fig. compare serum testosterone and L.H. levels in both castrated rats and rats castrated and injected with naloxone. It is clear that no significant change occured in both hormones of the two groups.

Group (5) : Rats castrated for one week testosterone replacement (2.5 mg/kg S.C. 48 and 24 hours before decapitation) :

Results are shown in table (10) and fig. (10). Serum testosterone levels ranged between 1.96 and 6.32 ng/ml with a mean value of 4.23 ± 1.76 ng/ml. Serum L.H. levels ranged between 3.42 and 9.37 miu/ml with a mean value of 6.36 ± 2.4 miu/ml.

Table (11) and fig. (11) compare serum testosterone and L.H. levels in control rats with the corresponding levels in rats castrated for one week with testosterone replacement. No significant change was found in serum testosterone in the two groups, while serum L.H. increased significantly from 2.73 ± 1.1 miu/ml in control group

to 6.36 ± 2.4 miu/ml following castration and testosterone replacement ($P<0.05$).

Table (12) and fig. (12) compare serum testosterone and L.H. levels in rats castrated for one week and rats castrated for one week with testosterone replacement. It was found that testosterone replacement resulted in a significant increase in serum testosterone from 1.04 ± 0.6 ng/ml (castrated rats) to 4.23 ± 1.76 ng/ml (castrated and testosterone - replaced rats) ($P<0.05$), while serum L.H. significantly decreased from 16.4 ± 3.0 miu/ml in castrated group to 6.36 ± 2.4 miu/ml in castrated and testosterone-replaced group ($P<0.005$).

Group (6) : Rats castrated for one week with testosterone replacement and injected S.C. with morphine 10mg/kg. :-

Results are shown in table (13) and fig. (13). Serum testosterone ranged between 1.97 and 5.18 ng/ml with a mean value of 3.55 ± 1.3 ng/ml. Serum L.H. ranged between 0.87 and 4.07 miu/ml with a mean value of 2.13 ± 1.4 miu/ml.

Table (14) and fig. (14) compare serum testosterone and L.H. levels in rats castrated with testosterone replacement and rats castrated with testonsterone replacement and injected S.C. with morphine 10 mg/kg. No significant

change was found regarding serum testosterone in the two groups, while serum L.H. decreased significantly from 6.36 ± 2.4 miu/ml in castrated rats replaced with testosterone to 2.13 ± 1.4 miu/mml in castrated and testosterone - replaced rats injected with morphine ($P<0.05$).

It can be concluded that the effects of blood testosterone and morphine are additive, which confirms the previous suggestion that opioid receptors stimulation shares in the feedback control of L.H. release by testosterone.

Group (7) : Rats castrated for one week with testosterone replacement and injected S.C. with naloxone 1 mg/kg:

Results are shown in table (15) and fig. (15). Serum testosterone ranged between 1.26 and 6.14 ng/ml with a mean value of 3.61 ± 1.9 ng/ml. Serum L.H. ranged between 8.37 and 21.35 miu/ml with a mean value of 14.2 ± 5.2 miu/ml.

Table (16) and fig. (16) compare serum testosterone and L.H. levels in rats castrated for one week with testosterone replacement and rats castrated for one week with testosterone replacement and injected S.C. with naloxone

1 mg/kg. No significant change was found in serum testosterone levels in the two groups, while serum L.H. significantly increased from 6.36 $\pm$ 2.4 miu/ml in castrated rats replaced with testosterone to 14.2 $\pm$ 5.2 miu/ml in castrated rats replaced with testosterone and injected with naloxone ($P<0.05$).

Still it can be concluded from these results that the opioid receptors which play a role in the feed back control of L.H. are of the μ-type; as their blood by the specific μ antagonists by naloxone mean a less abolished the testosterone-induced lower of plasma L.H. level.

Table (1): Serum levels of testosterone (ng/ml) and L.H (miu/ml) in control rats.

Rat No.	Testosterone (ng/ml)	L.H. (miu/ml)
1	3.11	2.39
2	4.19	3.60
3	1.86	1.87
4	3.55	1.80
5	4.05	4.67
6	2.74	2.05
Mean	3.25	2.73
S.D.	±0.90	±1.10

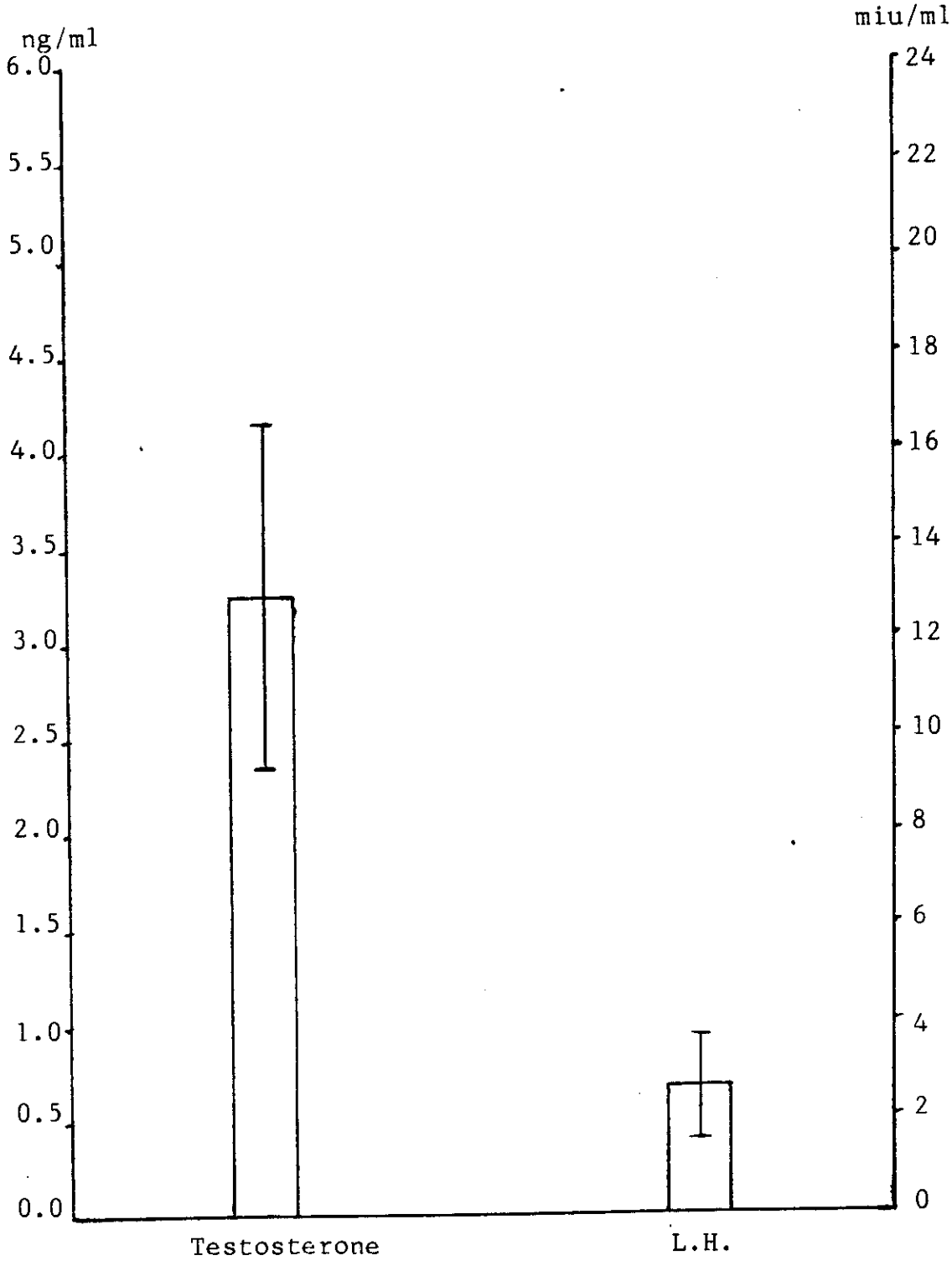

Fig. (1): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in control rats.

Table (2): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated for one week.

Rat No.	Testosterone (ng/ml)	L.H. (miu/ml)
1	1.70	14.61
2	0.32	15.31
3	1.17	20.96
4	1.50	16.49
5	0.43	12.59
6	1.12	18.44
Mean	1.04	16.40
S.D.	±0.60	±3.00

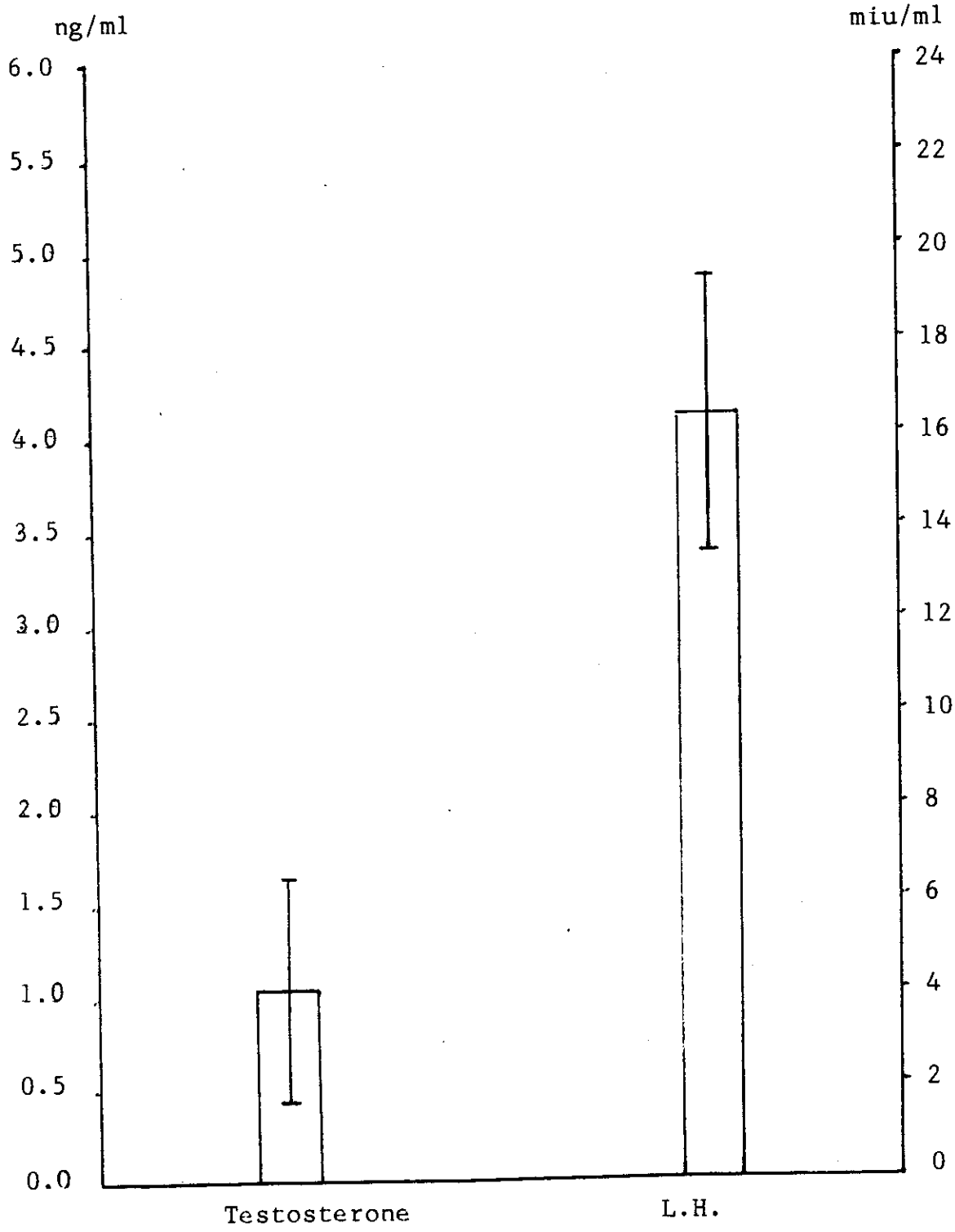

Fig. (2): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated for one week.

Table (3): Means and standard deviation of serum testosterone and L.H. levels in control rats and rats castrated for one weeks.

Group		Testosterone (ng/ml)	L.H. (miu/ml)
Control	Mean	3.25	2.73
	S.D.	±0.90	±1.10
Castrated	Mean	1.04*	16.40*
	S.D.	±0.60	±3.00
P		<0.01	<0.001

* significant change compared with the corresponding value in the control group.

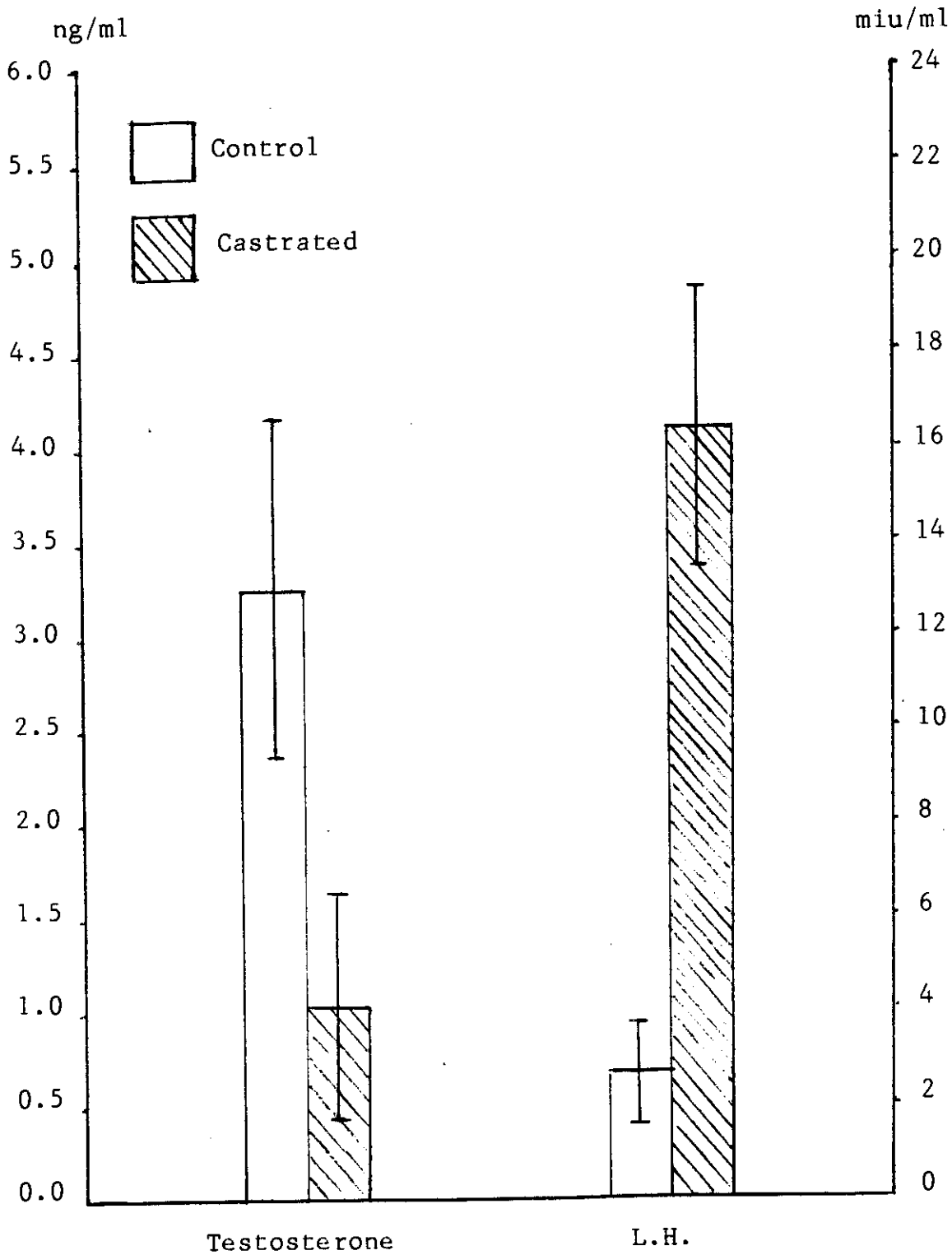

Fig. (3): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in control rats and rats castrated for one week.

Table (4): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated for one week and injected S.C. with morphine sulphate 10 mg/kg body weight.

Rat No.	Testosterone (ng/ml)	L.H. (miu/ml)
1	0.72	8.23
2	2.15	10.14
3	1.17	6.83
4	0.84	11.16
5	1.35	7.27
6	1.39	9.15
Mean	1.27	8.80
S.D.	±0.50	±1.70

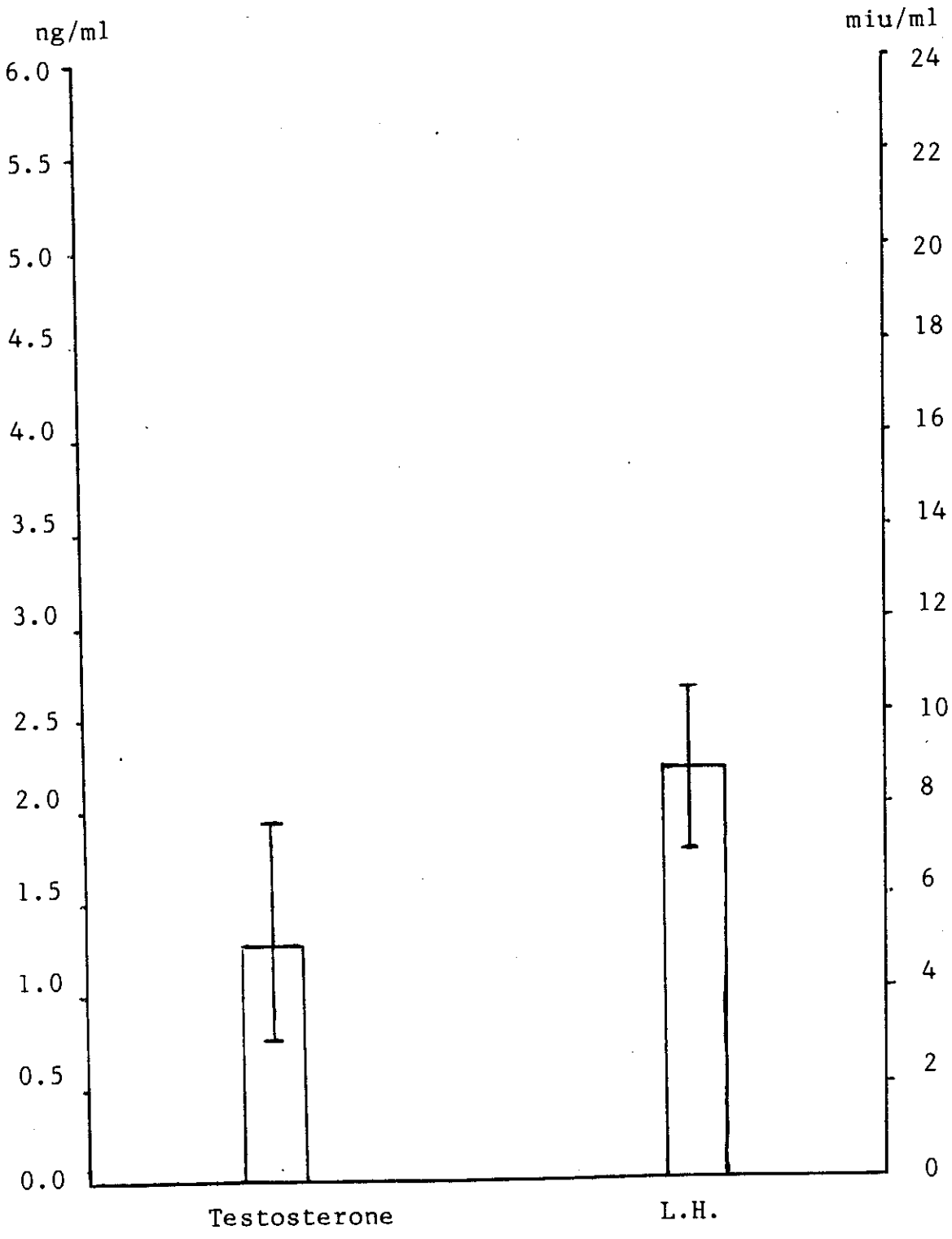

Fig. (4): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated for one week and injected S.C. with morphine sulphate 10 mg/kg.

Table (5): Means and standard deviations of serum testosterone and L.H levels in control rats and rats castrated for one week and injected S.C. with morphine 10 mg/kg.

Group		Testosterone (ng/ml)	L.H. (miu/ml)
Control	Mean	3.25	2.73
	S.D.	±0.90	±1.10
Castrated + Morphine	Mean	1.27*	8.80*
	S.D.	±0.50	±1.70
P		<0.01	<0.005

* significant change compared with the corresponding value in the control group.

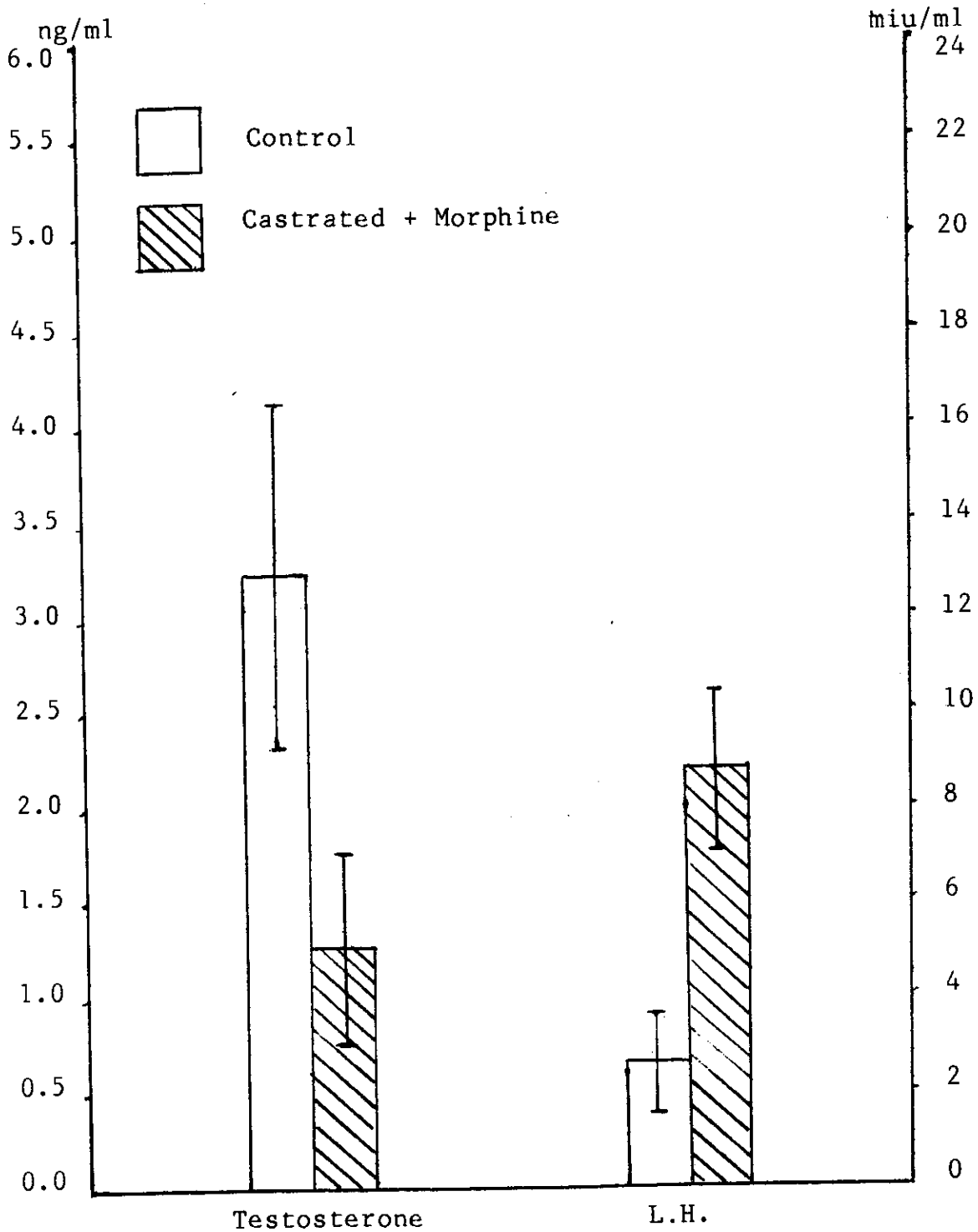

Fig. (5): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in control rats and rats castrated for one week and injected s.c.with morphine 10 mg/kg.

Table (6): Means and standard deviations of serum testosterone and L.H levels in rats castrated for one week and rats castrated for one week and injected S.C. with morphine 10 mg /Kg.

Group		Testosterone (ng/ml)	L.H. (miu/ml
Castrated	Mean	1.04	16.40
	S.D.	±0.60	±3.00
Castrated + Morphine	Mean	1.27	8.80*
	S.D.	±0.50	±1.70
P			0.01

* significant change compared with the corresponding value in the castrated group.

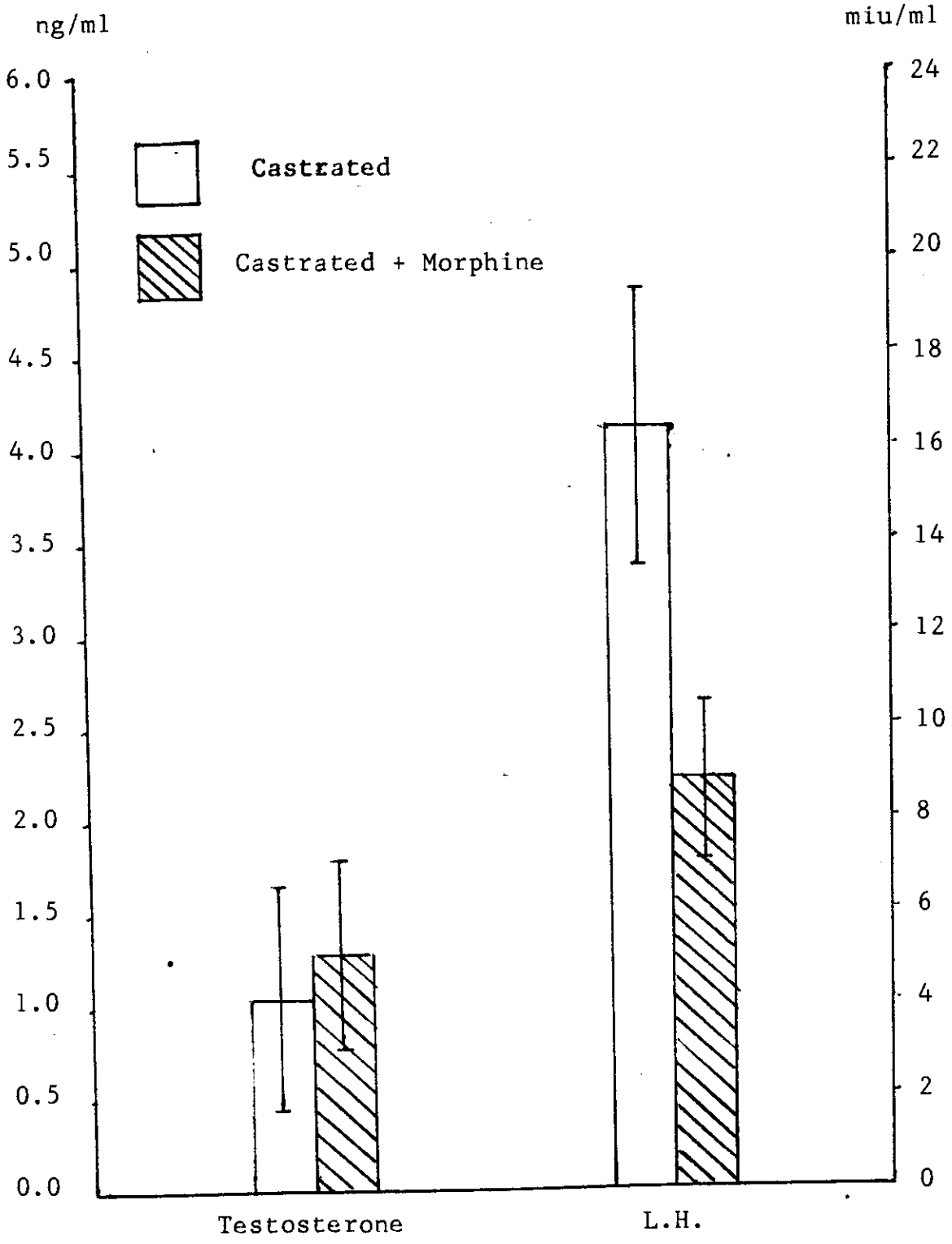

Fig. (6): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated for one week and rats cstrated and injected s.c. with morphine 10 mg/kg.

Table (7): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated for one week and injected S.C. with naloxone 1 mg /Kg.

Rat No.	Testosterone (ng/ml)	L.H. (miu/ml)
1	1.42	19.74
2	0.86	20.36
3	0.37	16.18
4	3.06	24.84
5	2.43	21.95
6	0.44	12.63
Mean	1.43	19.28
S.D.	±1.10	±4.30

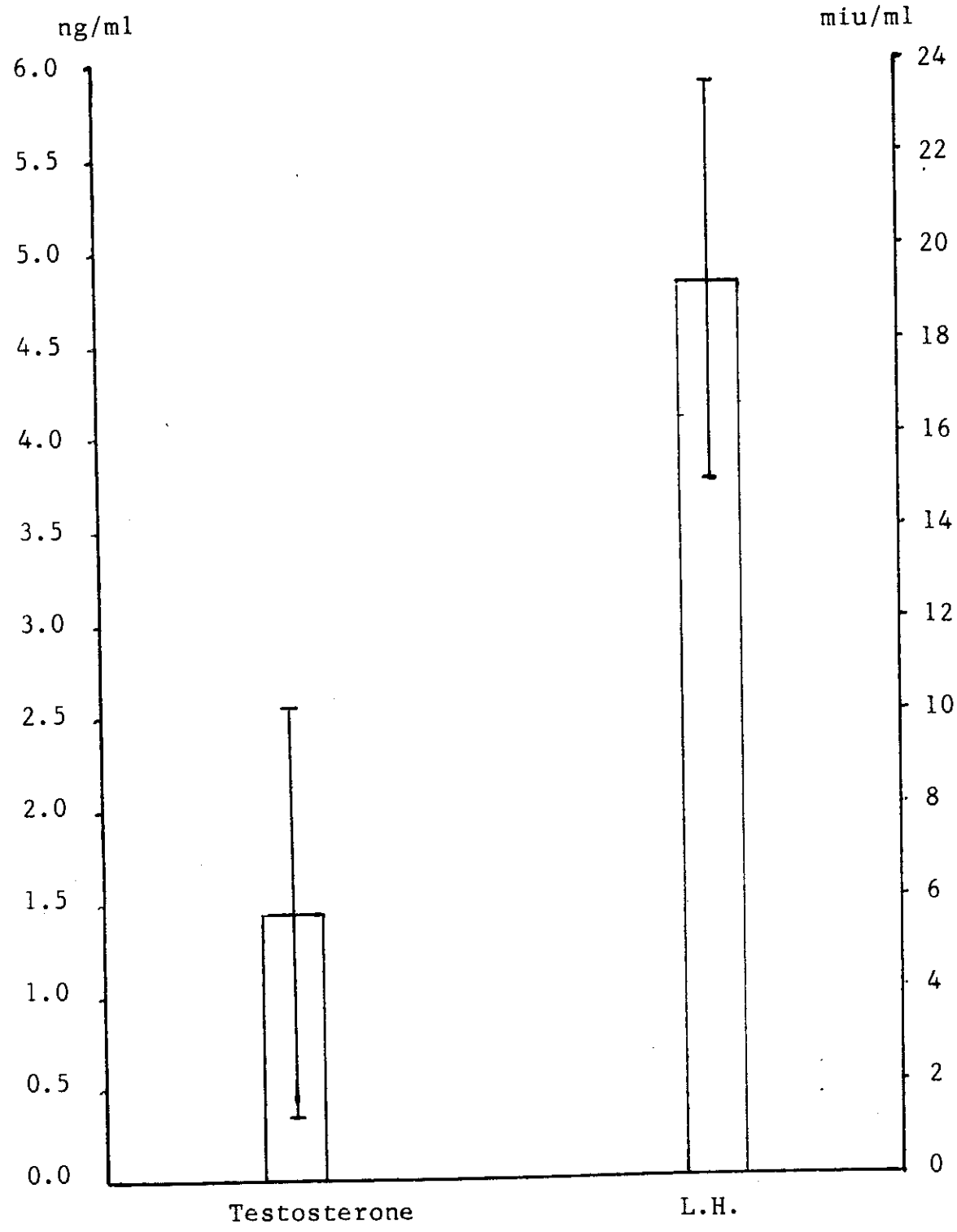

Fig. (7): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated for one week and injected s.c. with naloxone 1 mg/kg.

Table (8): Means and standard deviations of serum testosterone and L.H levels in control rats and rats castrated for one week and injected S.C. with naloxon 1 mg/Kg.

Group		Testosterone (ng/ml)	L.H. (miu/ml)
Control	Mean	3.25	2.73
	S.D.	±0.90	±1.10
Castrated + Naloxone	Mean	1.43*	19.28*
	S.D.	±1.10	±4.30
P		<0.05	<0.001

* significant change compared with the corresponding value in control group.

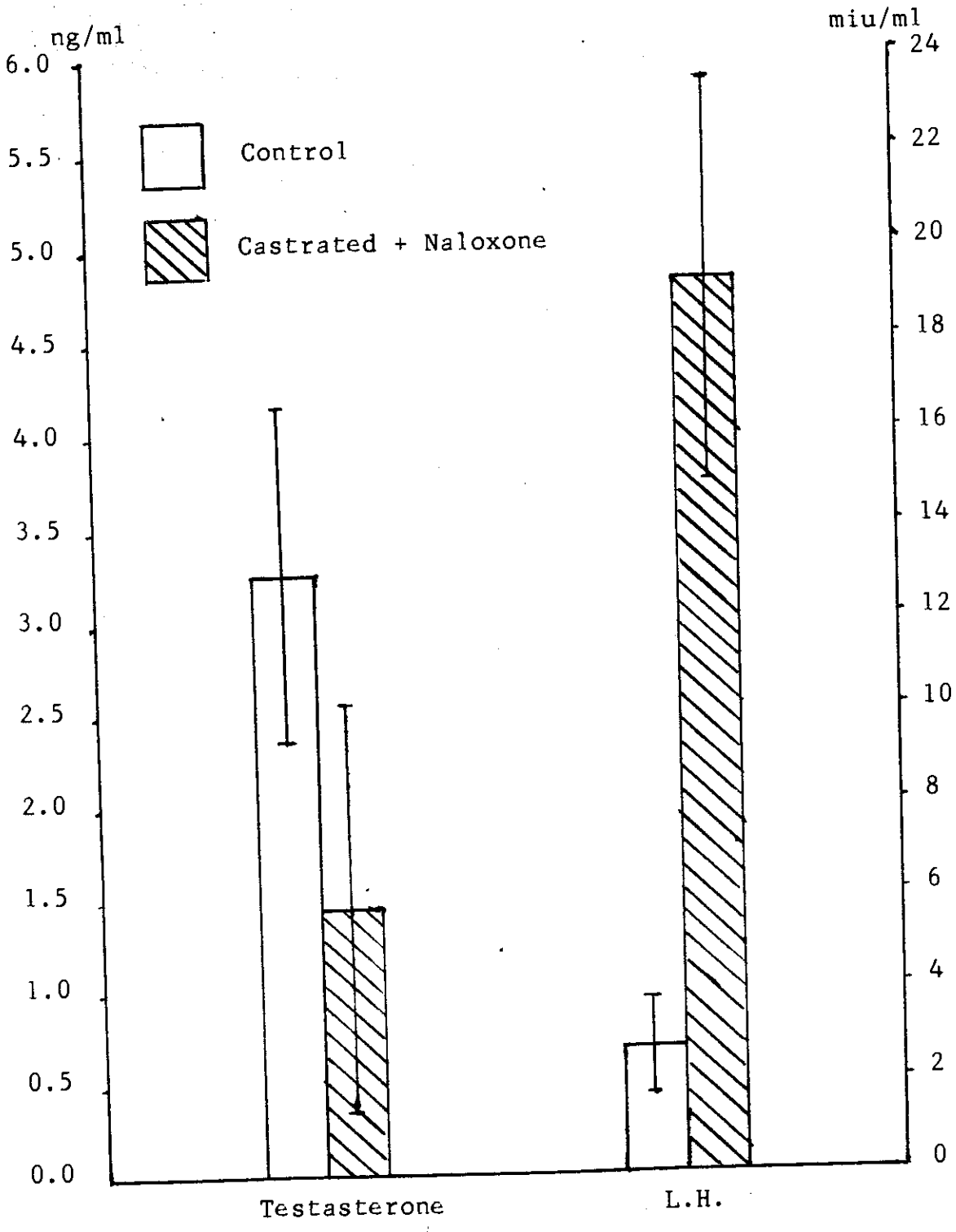

Fig. (8): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in control rats and rats castrated and injected s.c. with naloxone 1 mg/kg.

Table (9): Means and standard deviations of serum testosterone and L.H levels in rats castrated for one week and rats castrated for one week and injected S.C. with naloxone 1 mg/Kg.

Group		Testosterone (ng/ml)	L.H (miu/ml)
Castrated	Mean	1.04	16.40
	S.D.	±0.60	±3.00
Castrated + Naloxone	Mean	1.43	19.28
	S.D.	±1.10	±4.30
P			

No significant change in the corresponding values of the two groups.

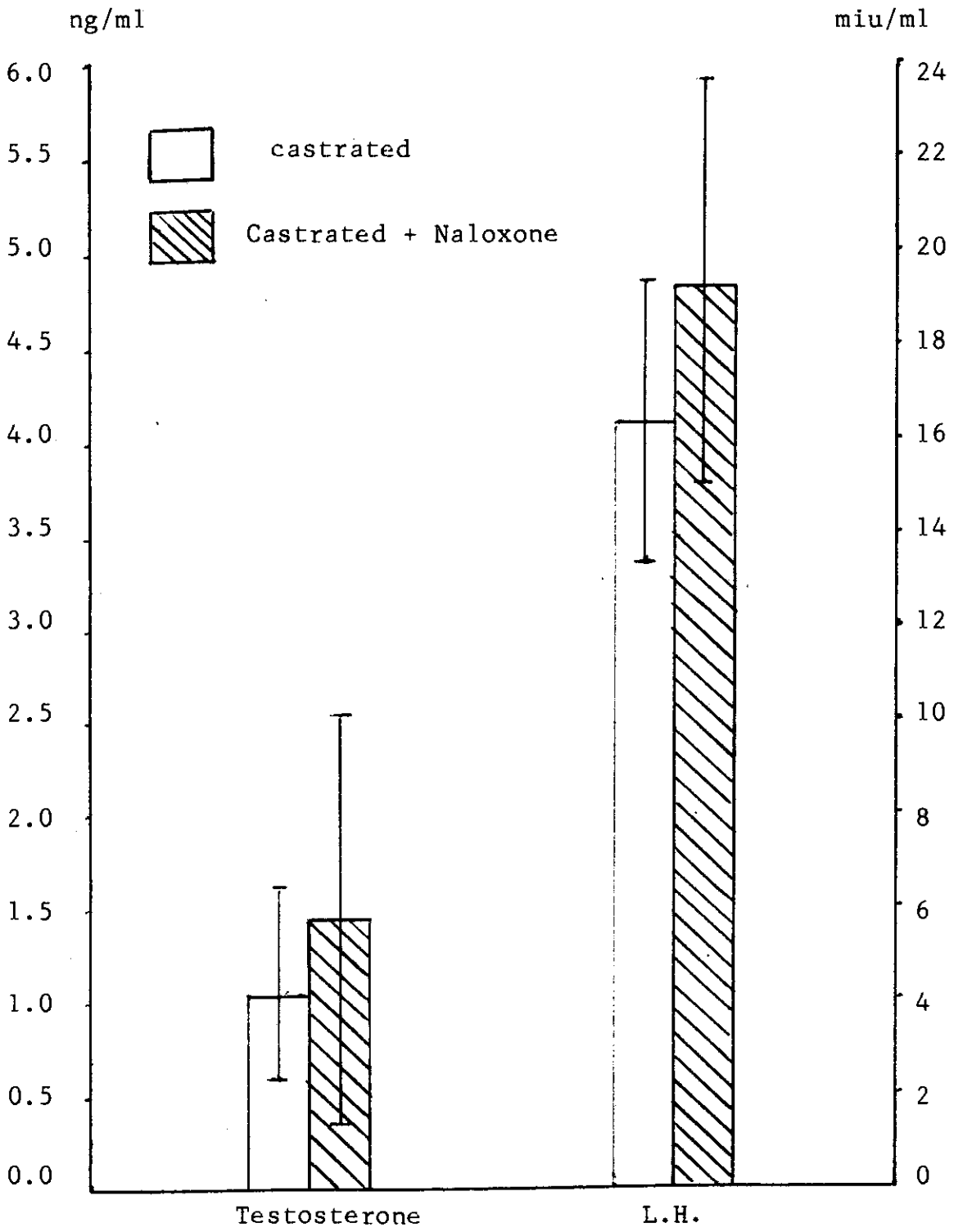

Fig. (9): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated for one week and rats castrated and injected s.c. with naloxone 1 mg/kg.

Table (10): Serum levels of testosterone (ng/ml) and L.H (miu/ml) in rats castrated for one week with testosterone replacement.

Rat No.	Testosterone (ng/ml)	L.H. (miu/ml)
1	2.41	3.49
2	6.32	9.37
3	4.82	6.74
4	5.78	8.25
5	1.96	3.42
6	4.65	6.91
Mean	4.23	6.36
S.D.	±1.76	±2.40

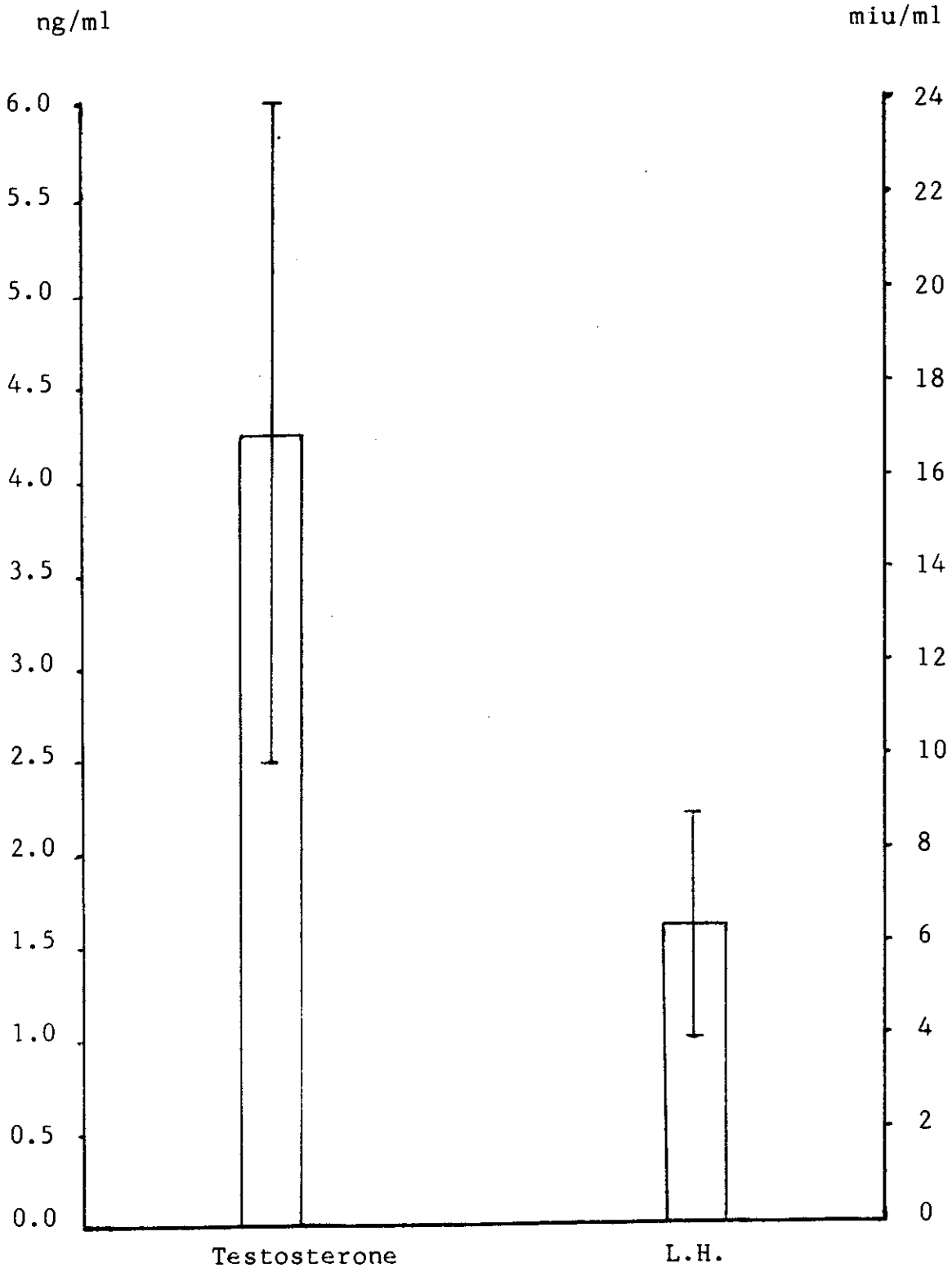

Fig. (10): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated for one week and replaced with testosterone.

Table (11): Means and standard deviations of serum testosterone and L.H. levels in control rats and rats castrated for one week with testosterone replacement.

Group		Testosterone (ng/ml)	L.H. (miu/ml)
Control	Mean	3.25	2.73
	S.D.	±0.90	±1.10
Castrated + Replacement	Mean	4.23	6.36*
	S.D.	±1.76	±2.40
P			<0.05

* significant change compared with the corresponding value in control group.

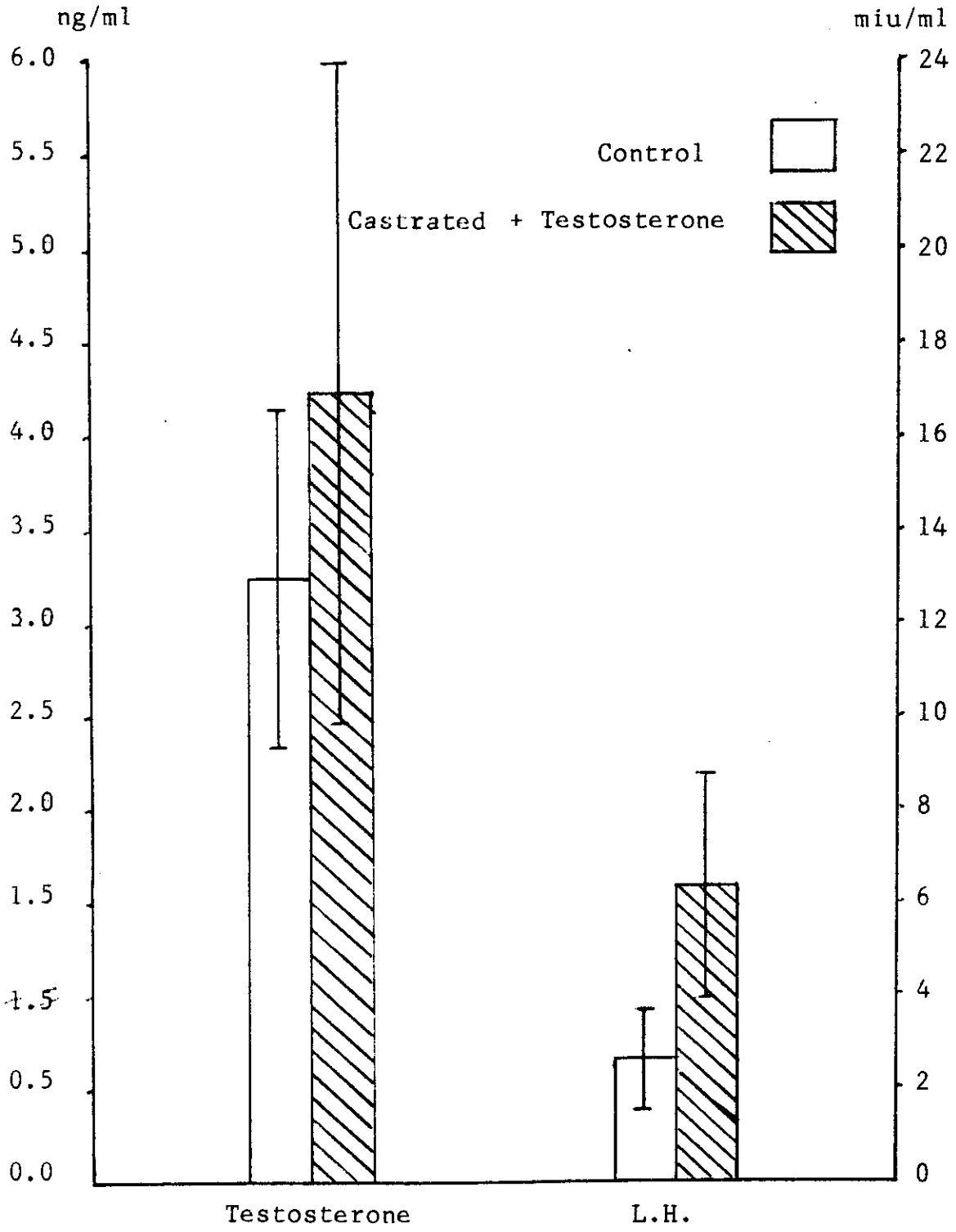

Fig. (11): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in control rats and rats castrated for one week and replaced with testosterone.

Table (12): Means and standard deviations of serum testosterone and L.H levels in rats castrated for one week and rats castrated for one week with testosterone repalcement.

Group		Testosterone (ng/ml)	L.H. (miu/ml)
Castrated	Mean	1.04	16.40
	S.D.	±0.60	±3.00
Castrated + Testosterone	Mean	4.23*	6.36*
	S.D.	±1.76	±2.40
P		<0.05	<0.005

* significant change compared with the corresponding value in the castrated group.

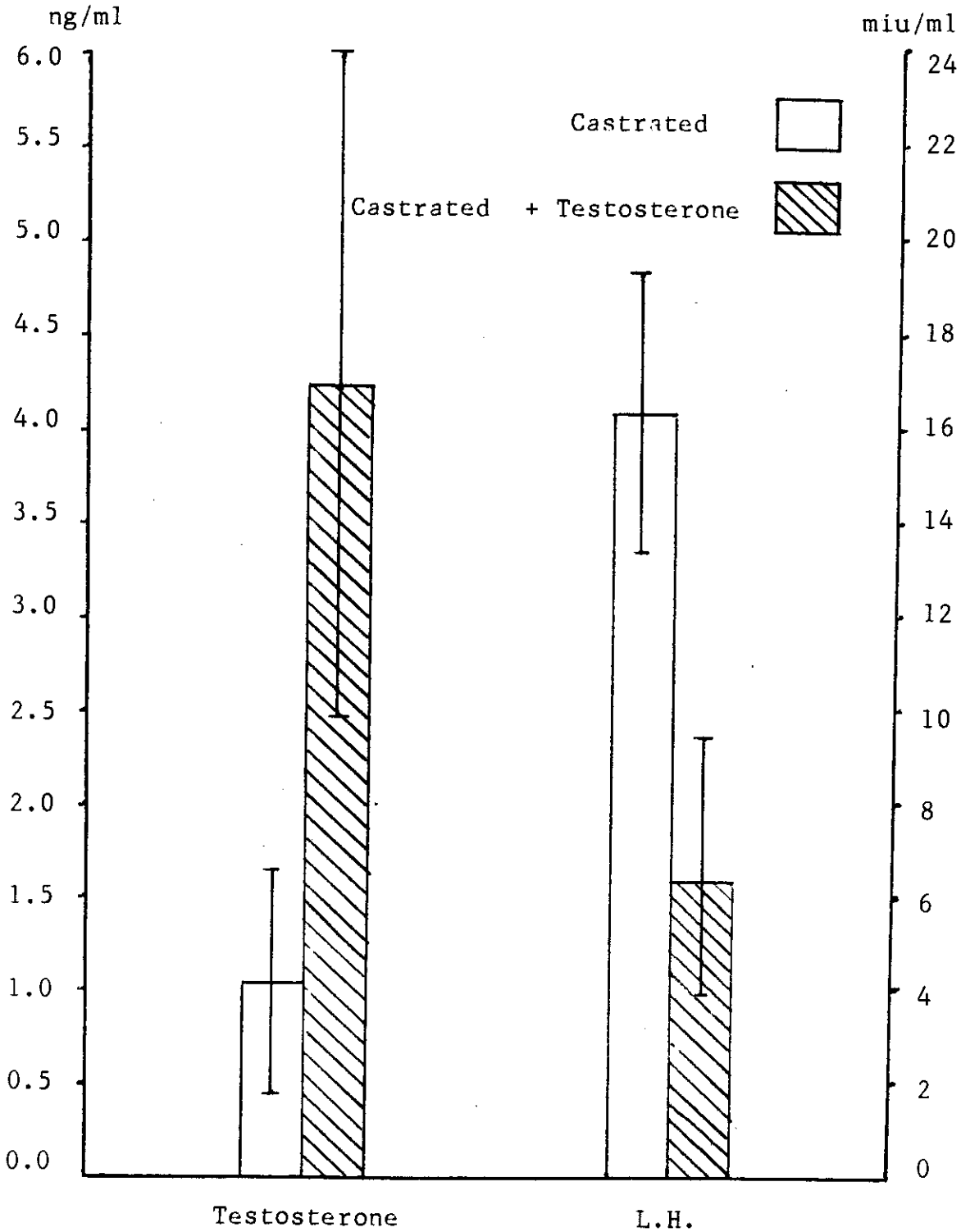

Fig. (12): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated for one week and rats castrated and replaced with testosterone.

Table (13): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated for one week with testosterone replacement and injected S.C. with morphine sulphate 10 mg /Kg body weight.

Rat No.	Testosterone (ng/ml)	L.H. (miu/ml)
1	4.62	4.07
2	1.97	1.68
3	2.14	0.95
4	3.56	1.43
5	5.18	3.78
6	3.82	0.87
Mean	3.55	2.13
S.D.	±1.30	±1.40

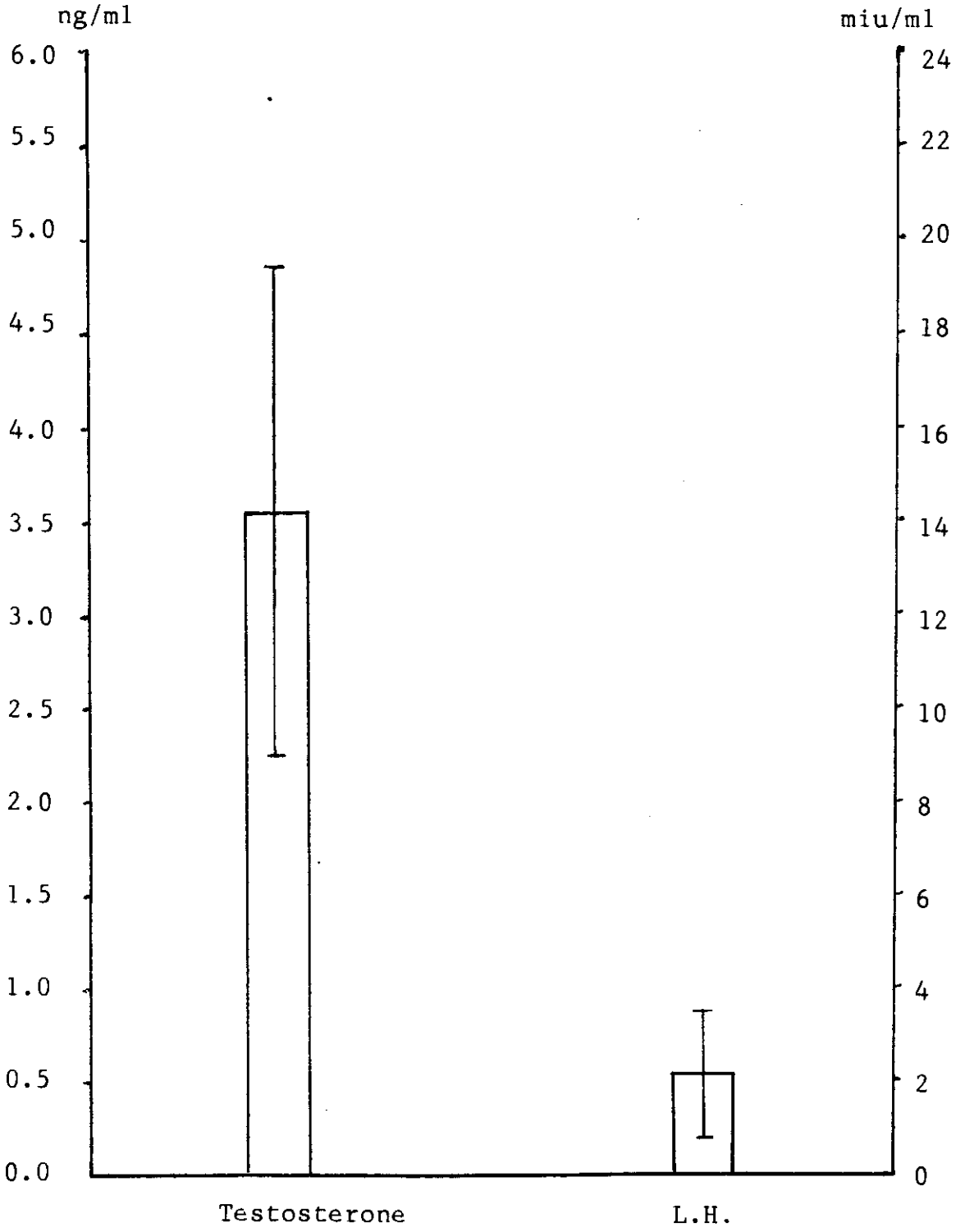

Fig. (13): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated, replaced with testosterone and injected s.c.with morphine 10 mg/kg.

Table (14): Means and standard deviations of serum testosterone and L.H. levels in rats castrated for one week with testosterone replacement and rats castrated for one weeks with testosterone replacement and injected S.C. with morphine 10 mg/Kg.

Group		Testosterone (ng/ml)	L.H. (miu/ml)
Castrated + Testosterone	Mean	4.23	6.36
	S.D.	±1.76	±2.40
Castrated + Testosterone + Morphine	Mean	3.55	2.13*
	S.D.	±1.30	±1.40
P			<0.05

* significant change compared with the corresponding value in rats castrated with testosterone replacement.

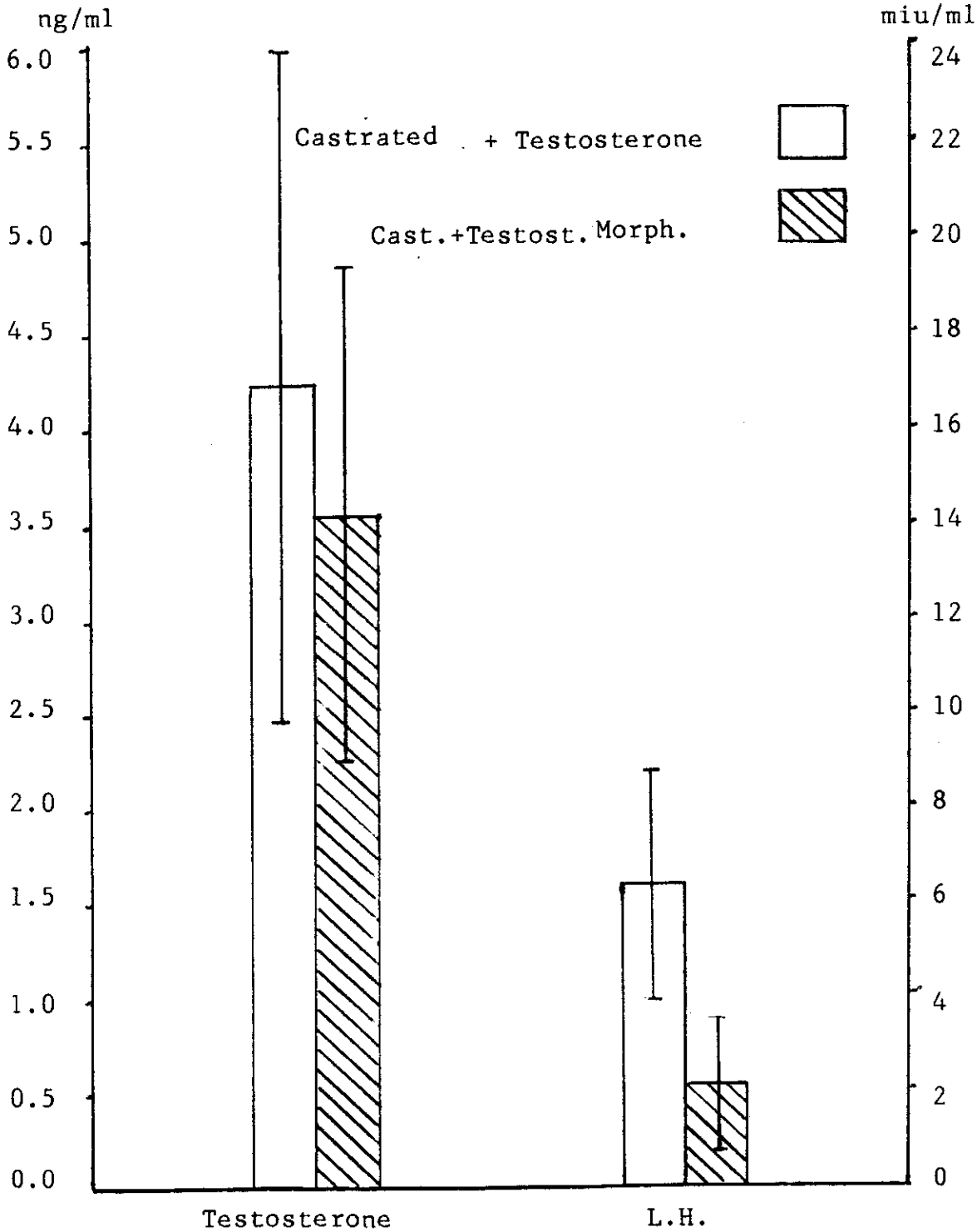

Fig. (14): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in castrated rats replaced with testosterone and rats castrated, replaced with testosterone and injected with morphine.

Table (15): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated for one week with testosterone replacement and injected S.C. with naloxone 1 mg/kg body weight.

Rats No.	Testosterone (ng/ml)	L.H. (miu/ml)
1	3.45	11.92
2	6.14	21.35
3	1.89	9.74
4	5.18	19.18
5	1.26	8.37
6	3.73	14.62
Mean	3.61	14.20
S.D.	±1.90	±5.20

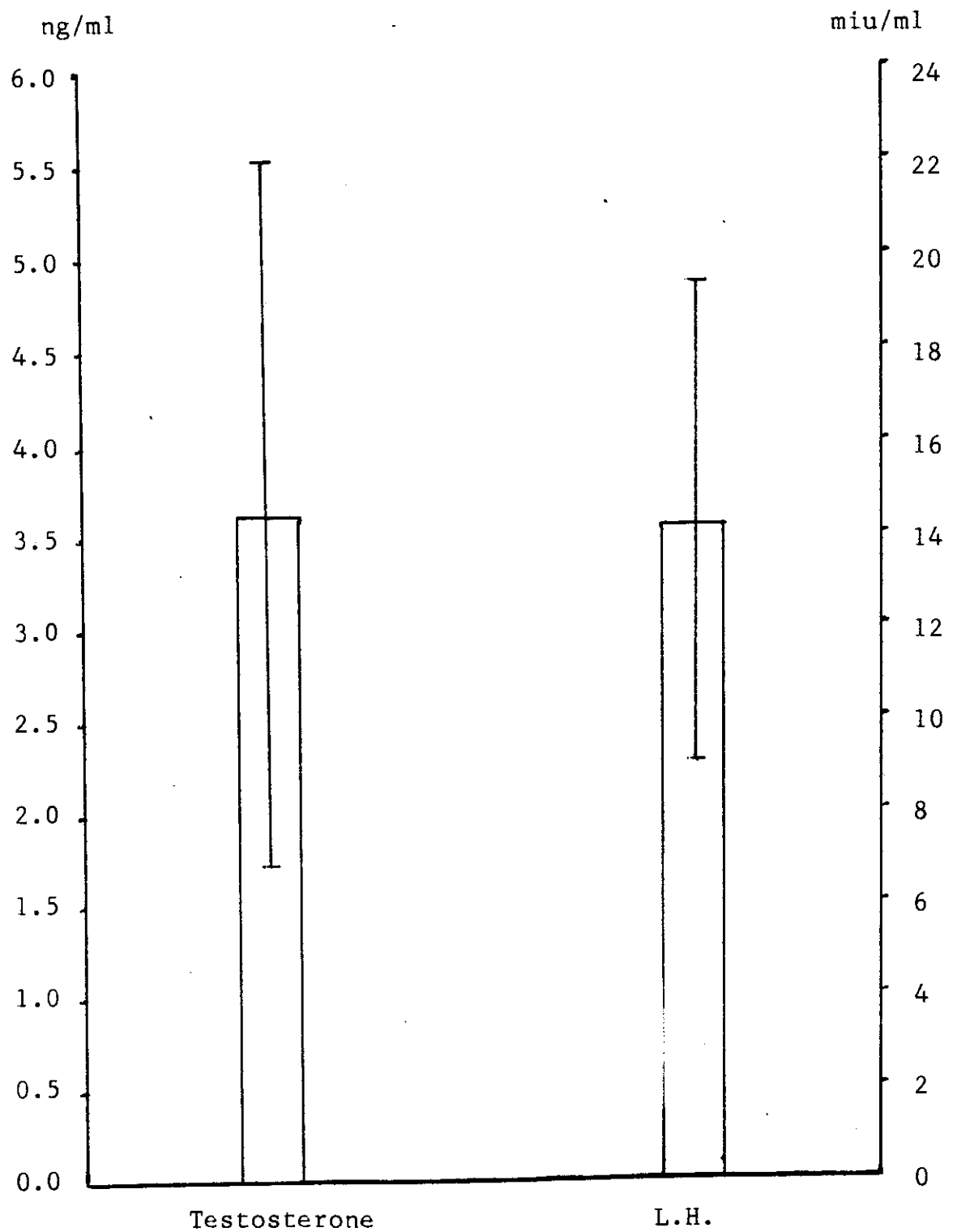

Fig. (15): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in rats castrated, replaced with testosterone and injected s.c. with naloxone 1 mg/kg.

Table (16): Means and standard deviations of serum testosterone and L.H levels in rats castrated for one week with testosterone replacement and rats castrated for one week with testosterone replacement and injected S.C. with naloxone 1 mg/kg.

Group		Testosterone (ng/ml)	L.H. (miu/ml)
Castrated + Testosterone	Mean	4.23	6.36
	S.D.	±1.76	±2.40
Castrated + Testosterone + Naloxone	Mean	3.61	14.20*
	S.D.	±1.90	±5.20
P			<0.05

* significant change compared with the corresponding value in the group of castration with testosterone replacement.

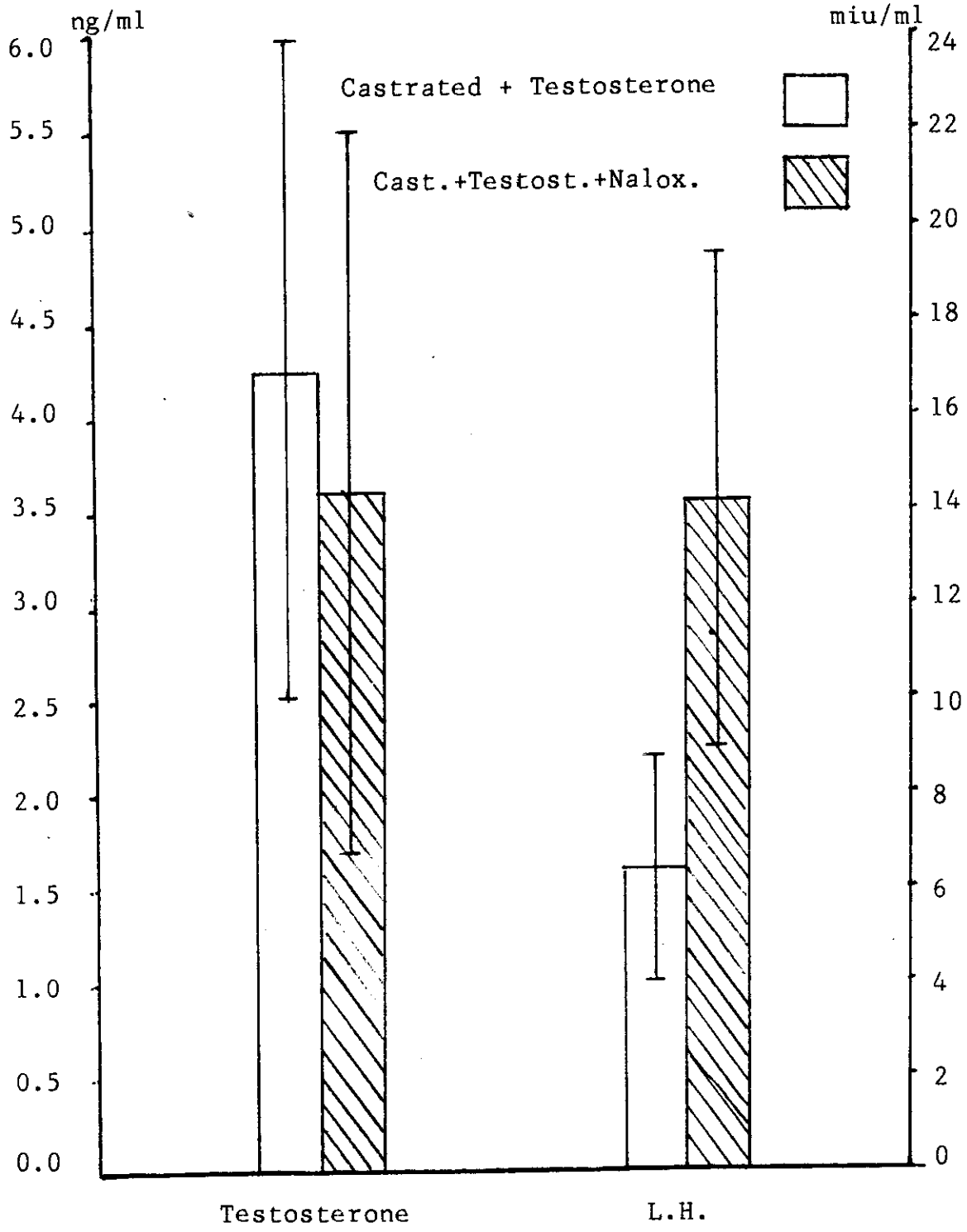

Fig. (16): Serum levels of testosterone (ng/ml) and L.H. (miu/ml) in castrated rats replaced with testosterone and rats castrated, replaced with testosterone and injected with nalxone.