

Endogenous anabolic hormones and strength training in male patients undergoing dialysis.

Molsted, S.¹, Andersen, J.L.², Eidemak, I.³, Harrison, A.P.⁴, Jørgensen, N.³

¹Hillerød Hospital, ²Bispebjerg Hospital, ³Rigshospitalet, ⁴Copenhagen University, Denmark.

Aim. to investigate circulating testosterone and IGF-1 before and after strength training in male patients undergoing dialysis and to investigate if hormone plasma levels were associated with muscle morphology.

Design. Controlled trial.

Patients. 20 male patients undergoing dialysis were included and 12 completed the study.

Intervention. 16 weeks control period and 16 weeks of resistance training thrice weekly. The training comprised leg press, knee extension, and knee flexion.

Main outcome measures.

- Testosterone, luteinizing hormone (LH), and IGF-1.
- Muscle fibre size and type composition in muscle biopsies from the vastus lateralis muscle.

Table 1. Patients (n=20)

Age (years)	65 (43-68)
HD/PD	19/1
Dialysis (years)	3.4 (2.6-7.0)
BMI (kg/m ²)	25.6 (23.4-28.7)
Haemoglobin (mmol/l)	7.4 (6.9-8.6)
Albumin (g/l)	42.1 (39.0-44.0)
Phosphate (mmol/l)	1.8 (1.3-2.1)
Bicarbonate (mmol/l)	25.0 (22.0-27.8)
CRP (mg/l)	4.0 (1.4-15.3)
Median (25%-75%)	

Figure 1. Testosterone correlated with age vs. norm mean data

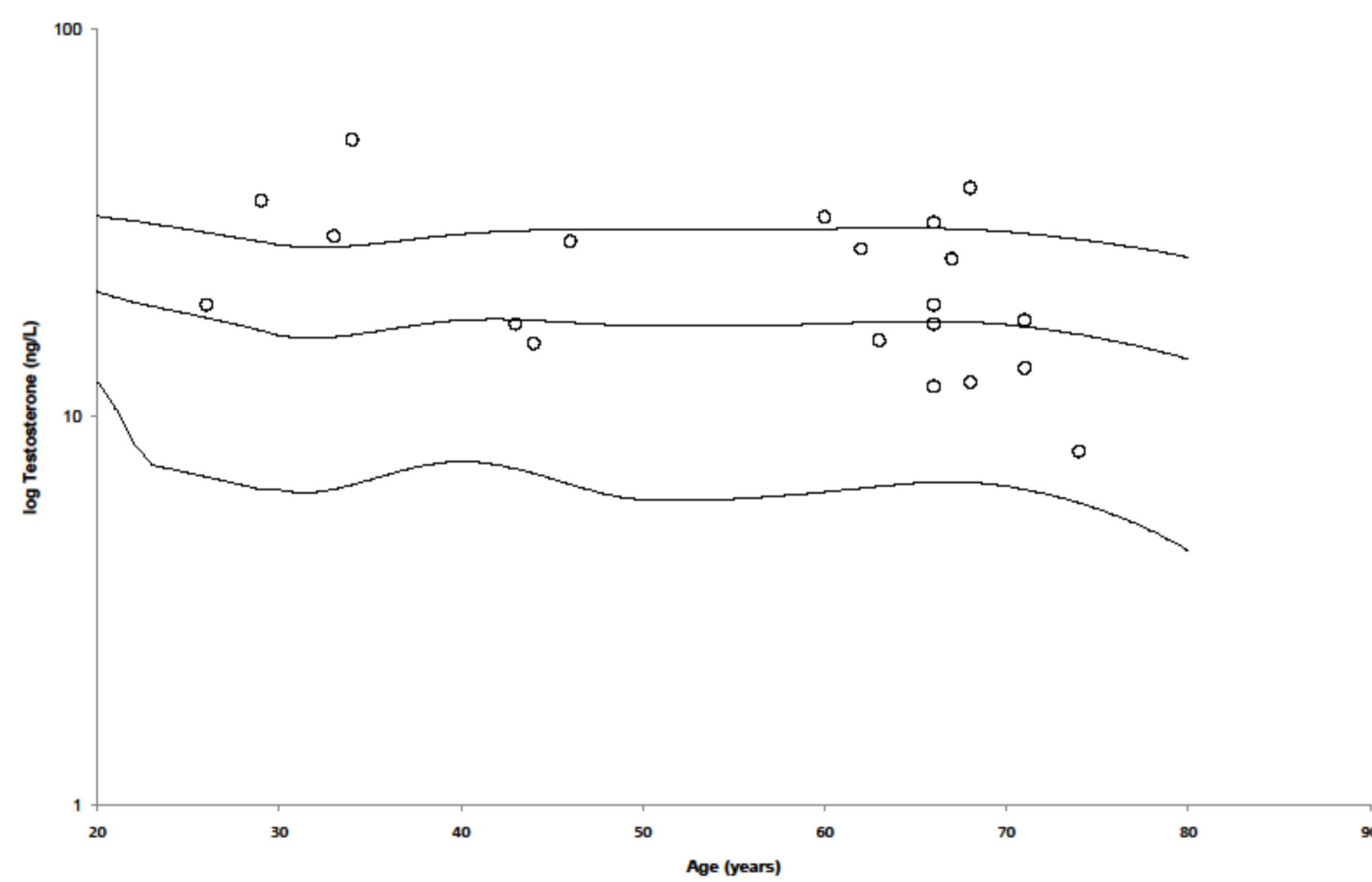


Figure 2. LH correlated with age vs. norm mean data

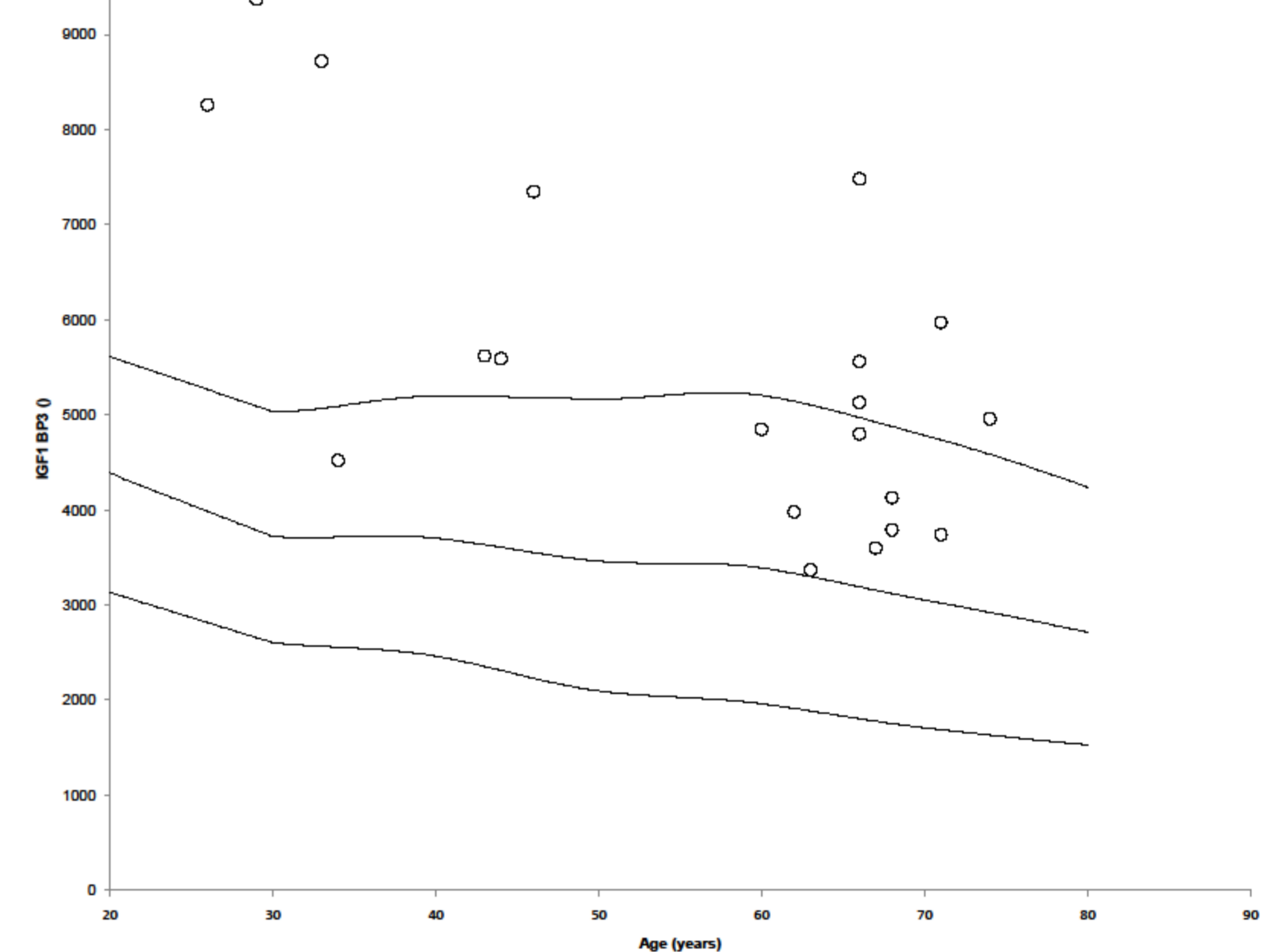


Table 2. Results (n=12).

Variable	Pre test	Baseline	Post test	P control	P training	P in-between
Total T (nmol/l)	21.7 (13.6-31.9)	18.7 (14.9-24.9)	19.8 (16.9-28.9)	0.695	0.326	0.099
Free T (pmol/l)	485 (312-636)	474 (366-606)	524 (266-636)	0.695	0.530	0.347
IGF-1 (ng/ml)	203 (183-323)	246 (164-331)	201 (133-359)	0.346	0.272	0.388
IGF-BP3 (ng/ml)	4905 (4115-5883)	4740 (4085-5890)	4525 (4248-6403)	0.754	0.844	0.937
IGF-1/ IGF-BP3 *	443 (371-571)	461 (355-582)	423 (339-561)	0.433	0.182	0.347
LH (U/l)	13.4 (10.3-25.5)	15.8 (12.8-23.4)	14.4 (7.1-18.9)	1.000	0.424	0.477
Total T/LH	1.83 (0.58-2.84)	1.55 (0.69-2.21)	1.82 (1.14-3.19)	0.084	0.110	0.041

Median (25%-75%). *x10,000

Figure 3. Total testosterone variation during the training period correlated with type 2 muscle fibre size variation during the training period ($r = 0.673$, $p = 0.033$).

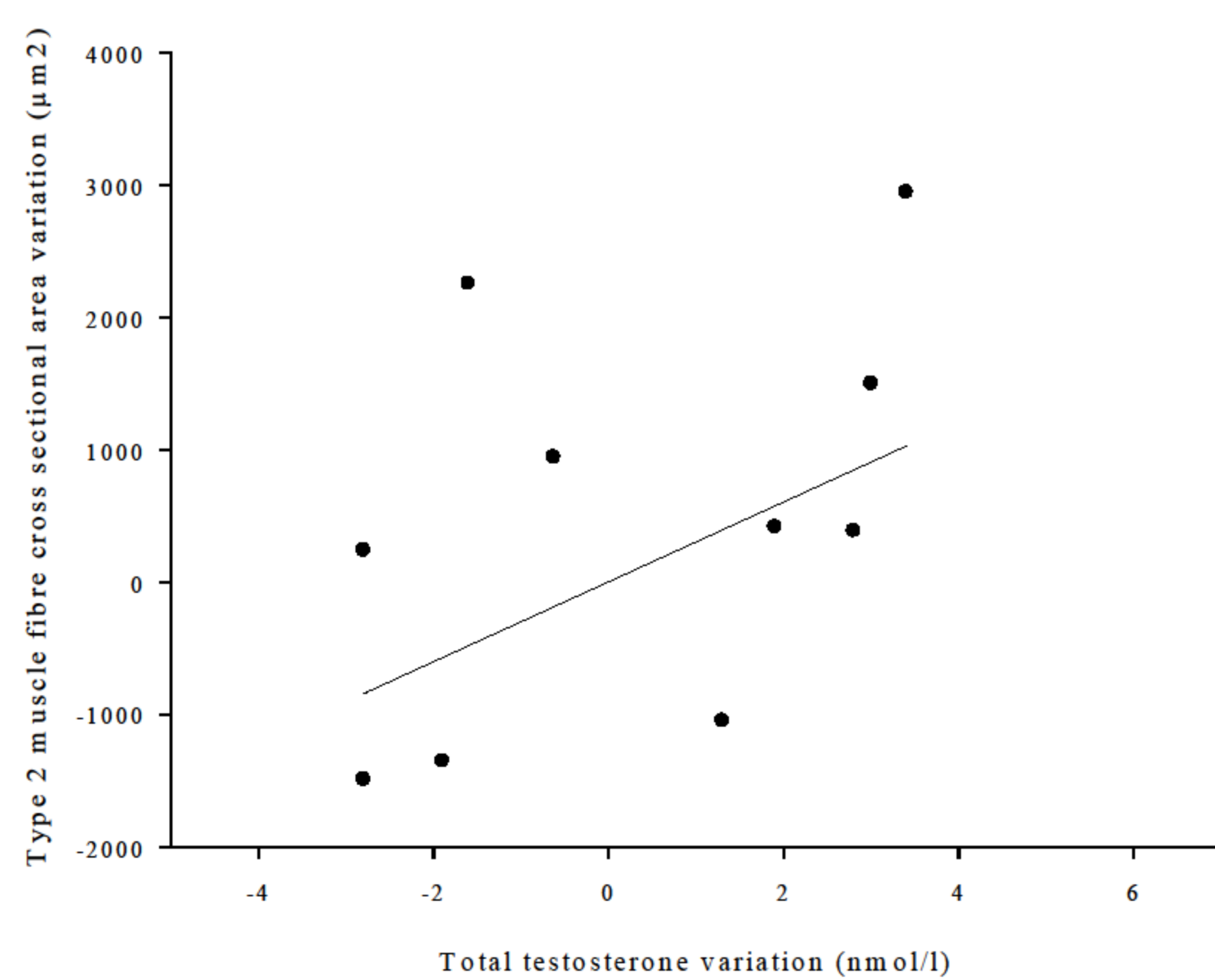
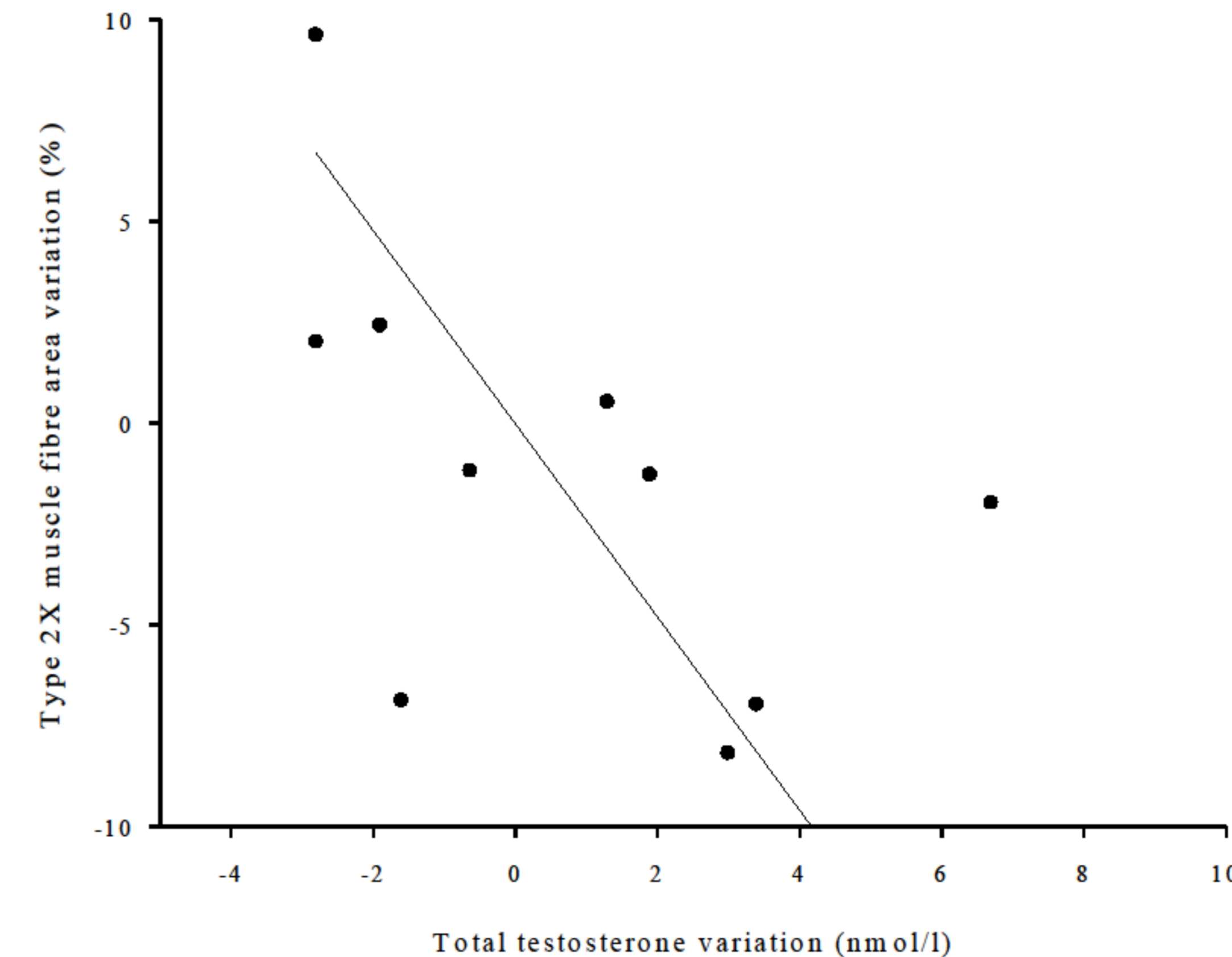


Figure 4. Total testosterone variation during the training period correlated to type 2X muscle fibre area variation during the training period ($r = -0.771$, $p = 0.017$).



Conclusions. Male patients undergoing dialysis may counteract impaired Leydig cell function through massive LH secretion. Resistance training was found to increase the testosterone/LH ratio suggesting an overall positive effect on the Leydig cells. During the 16 weeks of resistance training testosterone difference were positively associated with type 2 muscle fibre size difference and negatively with type 2X muscle fibre percentage difference suggesting causal associations.

