

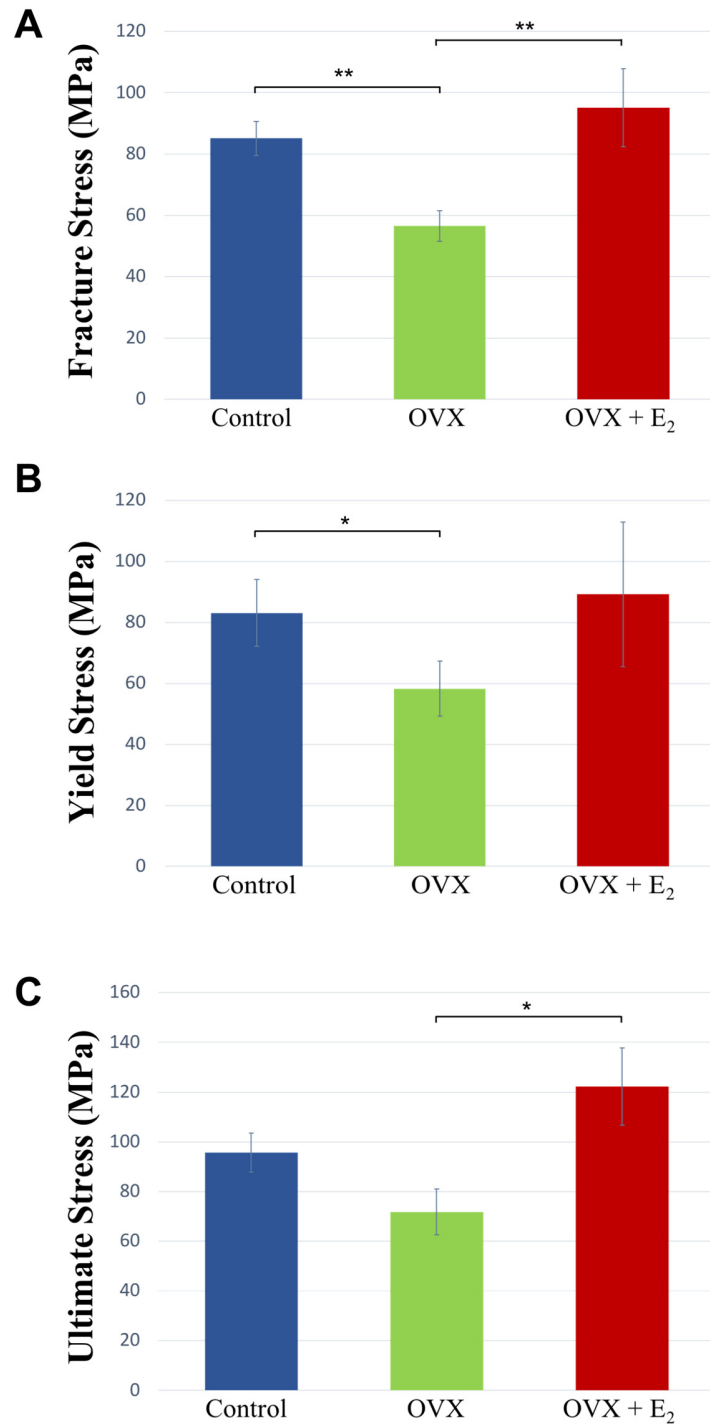
### Supplementary Figures

Study Week	Control BW (mean $\pm$ SE)	OVX BW (mean $\pm$ SE)	OVX + E <sub>2</sub> BW (mean $\pm$ SE)
1	18.92 $\pm$ 0.32	25.41 $\pm$ 0.49	20.96 $\pm$ 0.23
2	19.60 $\pm$ 0.26	28.42 $\pm$ 0.73	21.49 $\pm$ 0.21
3	20.44 $\pm$ 0.27	31.30 $\pm$ 0.96	22.44 $\pm$ 0.26
4	21.26 $\pm$ 0.37	33.69 $\pm$ 0.90	22.87 $\pm$ 0.26
5	21.68 $\pm$ 0.19	33.23 $\pm$ 1.22	23.78 $\pm$ 0.20
6	22.47 $\pm$ 0.41	34.75 $\pm$ 1.22	23.76 $\pm$ 0.24
7	23.10 $\pm$ 0.43	37.04 $\pm$ 1.05	23.84 $\pm$ 0.22
8	24.14 $\pm$ 0.53	39.25 $\pm$ 1.13	24.26 $\pm$ 0.23
9	25.26 $\pm$ 0.65	41.23 $\pm$ 1.02	25.29 $\pm$ 0.28
10	25.77 $\pm$ 0.90	42.09 $\pm$ 1.09	25.51 $\pm$ 0.35
11	26.89 $\pm$ 0.98	44.05 $\pm$ 0.91	26.25 $\pm$ 0.35
12	28.05 $\pm$ 1.11	45.90 $\pm$ 1.14	27.32 $\pm$ 0.35

**Supplementary Table S1:** Mean values  $\pm$  standard error of body weight (g) measured in each of the groups and over the 12-week study period.

Study Week	Control WG (mean $\pm$ SE)	OVX WG (mean $\pm$ SE)	OVX + E <sub>2</sub> WG (mean $\pm$ SE)
1	0.00	0.00	0.00
2	0.68 $\pm$ 0.25	3.01 $\pm$ 0.34	0.53 $\pm$ 0.15
3	0.84 $\pm$ 0.15	2.88 $\pm$ 0.44	0.96 $\pm$ 0.13
4	0.81 $\pm$ 0.15	2.38 $\pm$ 0.22	0.43 $\pm$ 0.11
5	0.42 $\pm$ 0.25	-0.47 $\pm$ 0.34	0.91 $\pm$ 0.13
6	0.79 $\pm$ 0.28	1.53 $\pm$ 0.35	-0.02 $\pm$ 0.14
7	0.63 $\pm$ 0.19	2.29 $\pm$ 0.23	0.08 $\pm$ 0.12
8	1.05 $\pm$ 0.19	2.20 $\pm$ 0.19	0.42 $\pm$ 0.12
9	1.12 $\pm$ 0.37	1.99 $\pm$ 0.31	1.02 $\pm$ 0.14
10	0.51 $\pm$ 0.30	0.86 $\pm$ 1.18	0.22 $\pm$ 0.19
11	1.12 $\pm$ 0.17	1.95 $\pm$ 0.36	0.74 $\pm$ 0.14
12	1.30 $\pm$ 0.45	2.18 $\pm$ 0.59	1.07 $\pm$ 0.20

**Supplementary Table S2:** Mean values  $\pm$  standard error of body weight gain (g) measured in each of the groups and over the 12-week study period.



**Supplementary Figure S1.** The mechanical properties of [A] fracture strength  $\sigma_f$ , [B] yield stress  $\sigma_y$ , [C] ultimate stress  $\sigma_u$ , and [D] elastic modulus  $E$ , at the tibial mid-point in the control, OVX, and OVX + E<sub>2</sub> groups ( $n = 6$ ) \* $p < 0.05$ , \*\* $p < 0.01$

<i>Variables</i>	<i>Control</i>	<i>OVX</i>	<i>OVX + E<sub>2</sub></i>
<i>Yield stress <math>\sigma_y</math> (MPa)</i>	125.27 ± 18.73	124.79 ± 18.72	123.44 ± 29.69
<i>Ultimate stress <math>\sigma_u</math> (MPa)</i>	143.94 ± 15.27	154.53 ± 19.55	170.06 ± 19.45
<i>Fracture stress <math>\sigma_f</math> (MPa)</i>	127.60 ± 10.66	121.63 ± 10.04	130.76 ± 29.42
<i>Elastic modulus E (GPa)</i>	2.91 ± 1.12	3.84 ± 0.79	2.85 ± 0.55

**Supplementary Table S3:** The biomechanical strength properties at the tibial midpoint in each of the groups. Values are normalized according to body weight and tibial length

<i>Variables</i>	<i>Control</i>	<i>OVX</i>	<i>OVX + E<sub>2</sub></i>
<i>Yield stress <math>\sigma_y</math> (MPa)</i>	83.11 ± 10.88	58.21 ± 9.06	89.17 ± 23.67
<i>Ultimate stress <math>\sigma_u</math> (MPa)</i>	95.69 ± 7.89	71.73 ± 9.24	122.32 ± 15.54
<i>Fracture stress <math>\sigma_f</math> (MPa)</i>	85.09 ± 5.57	56.49 ± 4.91	95.05 ± 12.68
<i>Elastic modulus E (GPa)</i>	1.92 ± 0.29	1.77 ± 0.36	2.06 ± 0.45

**Supplementary Table S4:** The biomechanical strength properties at the tibial midpoint in each of the groups. Values are [non-normalized] according to body weight and tibial length

	Control	OVX	OVX + E <sub>2</sub>
Control			
OVX	0.754		
OVX + E <sub>2</sub>	0.917	0.754	

**Supplementary Table S5:** [Unadjusted data]. *p* values obtained following the comparison of yield stress (MPa) in each of the groups.

	Control	OVX	OVX + E <sub>2</sub>
Control			
OVX	0.602		
OVX + E <sub>2</sub>	0.251	0.602	

**Supplementary Table S6:** [Unadjusted data]. *p* values obtained following the comparison of ultimate stress (MPa) in each of the groups.

	Control	OVX	OVX + E <sub>2</sub>
Control			
OVX	0.754		
OVX + E <sub>2</sub>	0.917	0.465	

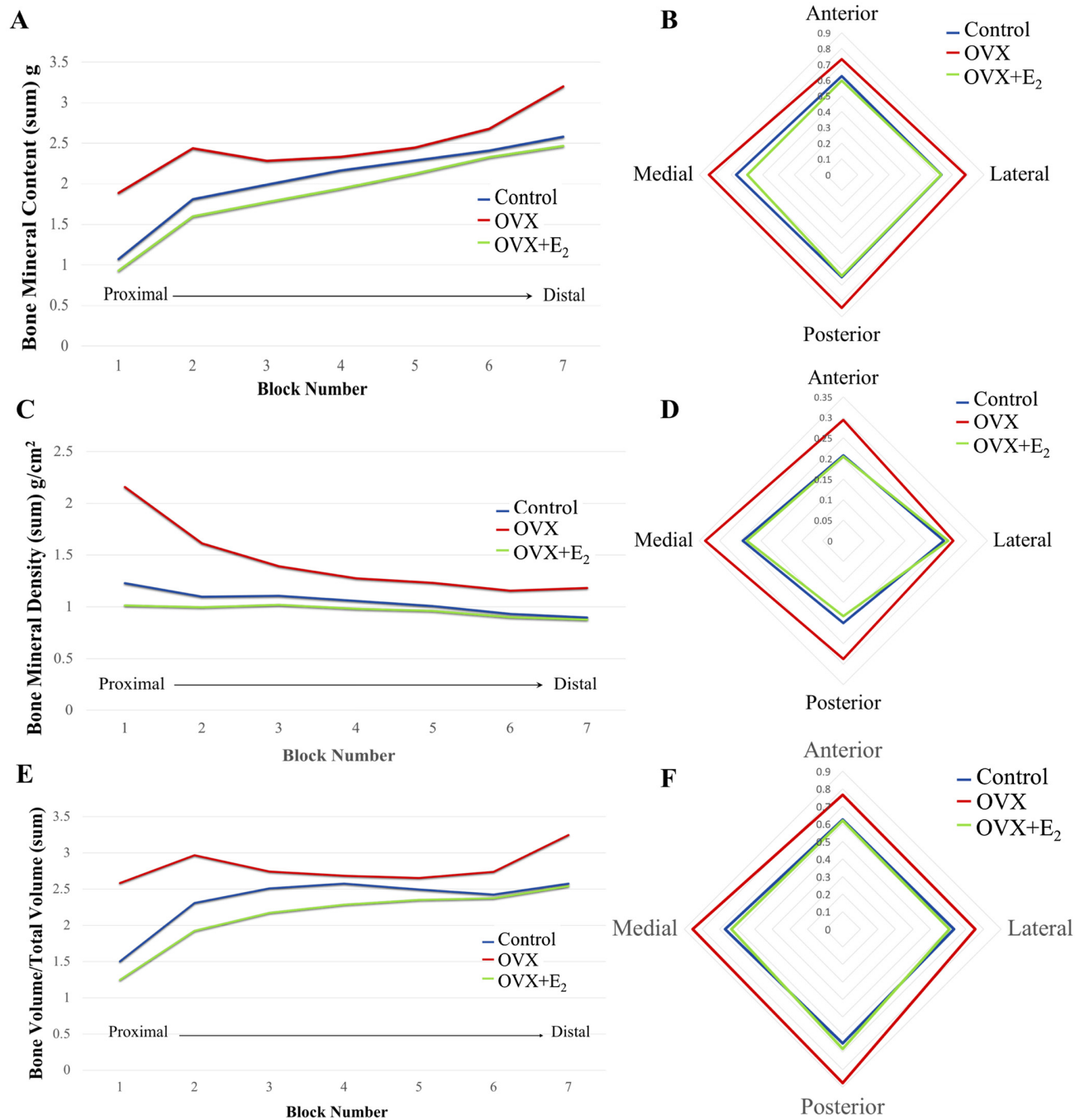
**Supplementary Table S7:** [Unadjusted data]. *p* values obtained following the comparison of fracture stress (MPa) in each of the groups.

	Control	OVX	OVX + E <sub>2</sub>
Control			
OVX	0.251		
OVX + E <sub>2</sub>	0.917	0.251	

**Supplementary Table S8:** [Unadjusted data]. *p* values obtained following the comparison of elastic modulus (GPa) in each of the groups.

	Control	OVX	OVX + E <sub>2</sub>
Control			
OVX			
OVX + E <sub>2</sub>			

**Supplementary Table S9:** [Unadjusted data]. *p* values obtained following the comparison of moment of inertia in each of the groups. \*denotes a significant difference



**Supplementary Figure S2.** [A] Bone mineral content (BMC) from the proximal (block 1) to the distal (block 7) region of the tibia in each of the experimental groups. [B] A comparison of BMC in the anterior, posterior, medial, and lateral aspects of the tibia. Similar results are presented for [C,D] BMD, and [E,F] BV/TV ( $n=1$ ).

<i>Variable</i>	<i>Control</i>	<i>OVX</i>	<i>OVX + E<sub>2</sub></i>
<i>Total BMC (g) whole bone</i>	7.327	6.749	10.010
<i>Total BMC by block</i>			
<i>1 (proximal)</i>	1.228	1.014	2.159
<i>2</i>	1.098	0.997	1.614
<i>3</i>	1.108	1.020	1.392
<i>4</i>	1.058	0.981	1.275
<i>5</i>	1.007	0.969	1.232
<i>6</i>	0.931	0.901	1.156
<i>7 (distal)</i>	0.896	0.877	1.184

**Supplementary Table S10.** Mean values of BMC (g) in whole bone and per block in each of the groups.

<i>Variable</i>	<i>Control</i>	<i>OVX</i>	<i>OVX + E<sub>2</sub></i>
<i>BMD (g.cm<sup>3</sup>) whole bone</i>	0.461	0.422	0.585
<i>BMD by block</i>			
<i>1</i>	0.267	0.232	0.472
<i>2</i>	0.452	0.399	0.609
<i>3</i>	0.497	0.443	0.570
<i>4</i>	0.542	0.485	0.583
<i>5</i>	0.572	0.531	0.611
<i>6</i>	0.603	0.582	0.670
<i>7</i>	0.645	0.617	0.780

**Supplementary Table S11.** Mean values of BMD (g.cm<sup>3</sup>) in whole bone and per block in each of the groups.

<i>Variable</i>	<i>Control</i>	<i>OVX</i>	<i>OVX + E<sub>2</sub></i>
<i>BV/TV whole bone</i>	0.547	0.490	0.689
<i>BV/TV by block</i>			
<i>1</i>	0.375	0.311	0.646
<i>2</i>	0.577	0.481	0.742
<i>3</i>	0.627	0.543	0.685
<i>4</i>	0.644	0.571	0.671
<i>5</i>	0.624	0.587	0.663
<i>6</i>	0.606	0.593	0.685
<i>7</i>	0.644	0.635	0.812

**Supplementary Table S12.** Mean values of BV/TV in whole bone and per block in each of the groups.

<i>Variables</i>	<i>Control</i>	<i>OVX</i>	<i>OVX + E<sub>2</sub></i>
<i>AP-ML tibia bone mineral and volume levels</i>			
<i>BMD (g.cm<sup>3</sup>):</i>			
<i>Anterior</i>	0.486	0.427	0.588
<i>Lateral</i>	0.505	0.465	0.625
<i>Medio</i>	0.405	0.394	0.561
<i>Posterior</i>	0.438	0.399	0.564
<i>BMC (g):</i>			
<i>Anterior</i>	1.994	1.931	2.819
<i>Lateral</i>	2.079	1.776	2.582
<i>Medio</i>	1.373	1.222	1.987
<i>Posterior</i>	1.880	1.821	2.622
<i>BV/TV:</i>			
<i>Anterior</i>	0.613	0.532	0.724
<i>Lateral</i>	0.576	0.507	0.711
<i>Medio</i>	0.480	0.468	0.659
<i>Posterior</i>	0.508	0.449	0.656

**Supplementary Table S13:** Tibial bone mineral and volume levels in the antero-posterior and medio-lateral aspects. Data obtained from 1 animal per group.