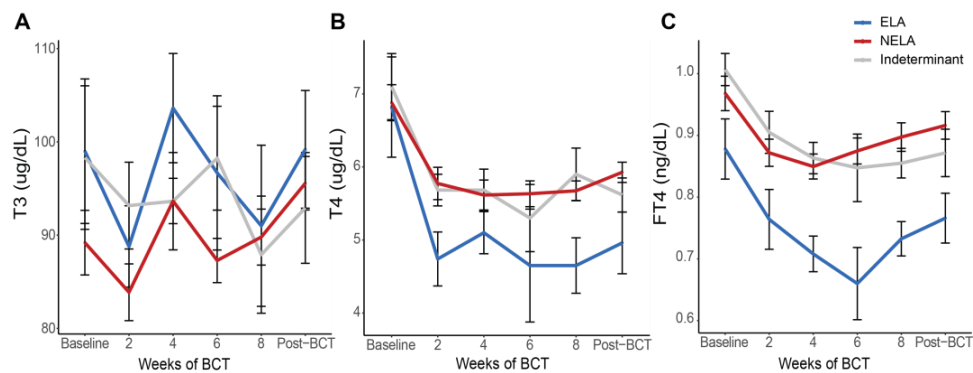


Supplemental Figure 1. Flow diagram of subject enrollment, exclusion, data collection and analyses leading to our primary analysis of hypothalamic-pituitary-ovarian (HPO) axis function.



Supplemental Figure 2. Serum A) triiodothyronine (T3), B) thyroxine (T4) and C) free thyroxine (FT4) in trainees with evidence of luteal activity (ELA; n=7), without evidence of luteal activity (NELA; n=41), and with indeterminant luteal activity (n=7). Data are presented as mean(SEM).

Supplemental Table 1. Characteristics of trainees excluded from the study and those in the overall included cohort.

	Excluded (n = 49)	Cohort (n = 55)	p-value
Age (yr)	20 [19, 21]	22 [20, 23]	0.062
Height (m)	1.62 [1.61, 1.64]	1.61[1.60, 1.62]	0.24
Weight (kg)	60.2 [57.9, 62.6]	61.9 [59.6, 64.2]	0.31
BMI (kg·m ⁻²)	22.9 [22.1, 23.7]	23.9 [23.1, 24.7]	0.088
Fat free mass (kg)	39.8 [38.4, 41.1]	40.8 [39.3, 42.2]	0.32
Fat mass (kg)	18.6 [17.1, 20.0]	19.1 [17.8, 20.5]	0.56
% body fat	31.4 [29.8, 33.0]	31.65 [30.1, 33.2]	0.84
Race/ethnicity (n, %)			
Black	24 (49%)	18 (33%)	0.27
Other	9 (18%)	17 (31%)	0.25
White	16 (33%)	20 (36%)	0.78
Recent smoking (n, %)	5 (10%)	6 (11%)	0.92
Sleep per night (hrs)	7.2 [6.8, 7.6]	7.5 [7.0, 8.0]	0.76

Values are presented as mean [95% confidence interval] or n (%) per group.

Supplemental Table 2. Luteinizing hormone (LH; mIU/mg cr) in the entire cohort and in trainees with evidence of luteal activity (ELA; n=7), with no evidence of luteal activity (NELA; n=44), and with indeterminant luteal activity (n=7).

	Cohort (n = 55)	ELA (n = 7)	NELA (n = 41)	Indeterminant (n = 7)
Day of Cycle				
-14	7.27 [3.06, 11.48]	3.00 [0.65, 5.35]	3.38 [2.35, 4.41]	3.29 [0.30, 6.28]
-13	7.71 [4.18, 11.24]	2.76 [0.83, 4.69]	3.69 [2.58, 4.80]	3.11 [0.32, 5.90]
-12	7.93 [3.54, 12.32]	3.95 [-0.3, 8.20]	3.78 [2.39, 5.17]	3.56 [1.27, 5.85]
-11	6.07 [3.39, 8.75]	2.66 [2.05, 3.27]	3.38 [2.22, 4.54]	4.23 [1.16, 7.30]
-10	6.89 [3.52, 10.26]	2.93 [1.94, 3.92]	3.05 [1.98, 4.12]	4.22 [0.39, 8.05]
-9	9.14 [4.75, 13.53]	2.87 [0.39, 5.35]	2.63 [2.04, 3.22]	4.08 [0.01, 8.15]
-8	9.78 [3.58, 15.98]	3.71 [1.33, 6.09]	2.38 [1.88, 2.88]	5.11 [0.67, 9.55]
-7	7.27 [3.3, 11.24]	3.18 [1.03, 5.33]	3.26 [2.14, 4.38]	4.66 [1.31, 8.01]
-6	6.53 [2.38, 10.68]	3.26 [0.54, 5.98]	2.84 [2.26, 3.42]	4.27 [0.56, 7.98]
-5	5.41 [2.14, 8.68]	18.35 [-22.93, 59.63]	2.50 [1.83, 3.17]	3.13 [-0.66, 6.92]
-4	6.21 [2.77, 9.65]	6.56 [-2.47, 15.59]	3.56 [1.69, 5.43]	3.39 [-1.50, 8.28]
-3	6.17 [2.45, 9.89]	3.65 [0.58, 6.72]	3.76 [1.84, 5.68]	2.93 [-3.52, 9.38]
-2	3.48 [2.16, 4.80]	5.47 [0.42, 10.52]	2.88 [1.87, 3.89]	2.16 [0.07, 4.25]
-1	8.89 [4.77, 13.01]	7.14 [-3.41, 17.69]	4.31 [2.33, 6.29]	6.23 [-7.40, 19.86]
0	12.71 [8.17, 17.25]	13.3 [3.11, 23.49]	6.29 [3.84, 8.74]	15.49 [-0.21, 31.19]
1	8.60 [3.57, 13.63]	4.77 [3.30, 6.24]	2.70 [1.87, 3.53]	8.04 [-9.33, 25.41]
2	6.76 [3.64, 9.88]	4.01 [-1.64, 9.66]	3.68 [1.88, 5.48]	2.39 [0.07, 4.71]
3	9.18 [4.27, 14.09]	4.69 [-5.74, 15.12]	2.85 [1.95, 3.75]	3.49 [-1.13, 8.11]
4	9.70 [4.41, 14.99]	2.66 [-0.13, 5.45]	2.99 [1.83, 4.15]	2.45 [-0.23, 5.13]
5	7.82 [2.32, 13.32]	1.97 [0.37, 3.57]	2.40 [1.75, 3.05]	1.6 [-0.04, 3.24]
6	5.75 [2.18, 9.32]	3.31 [-3.28, 9.90]	2.47 [1.56, 3.38]	2.52 [-2.40, 7.44]
7	5.47 [2.87, 8.07]	1.31 [0.32, 2.30]	3.48 [1.94, 5.02]	3.16 [-0.13, 6.45]
8	6.37 [1.75, 10.99]	1.98 [-0.39, 4.35]	2.58 [1.80, 3.36]	1.25 [0.17, 2.33]
9	7.03 [2.36, 11.70]	1.52 [-0.61, 3.65]	2.44 [1.64, 3.24]	1.03 [-0.81, 2.87]
10	5.71 [2.23, 9.19]	1.18 [-1.27, 3.63]	2.38 [1.81, 2.95]	1.37 [-0.76, 3.50]
11	5.18 [1.65, 8.71]	1.53 [0.68, 2.38]	2.67 [1.67, 3.67]	1.27 [-0.46, 3.00]
12	4.68 [1.96, 7.40]	1.54 [-0.35, 3.43]	3.61 [2.29, 4.93]	1.94 [-0.36, 4.24]
13	4.72 [-0.65, 10.09]	1.99 [0.34, 3.64]	3.08 [2.18, 3.98]	6.51 [-6.96, 19.98]
14	4.71 [0.94, 8.48]	1.99 [1.09, 2.89]	3.20 [1.87, 4.53]	7.09 [-1.81, 15.99]

Values are presented as mean [95% confidence interval] per group.

Supplemental Table 3. Follicle stimulating hormone (FSH; mIU/mg cr) in the entire cohort and in trainees with evidence of luteal activity (ELA; n=7), with no evidence of luteal activity (NELA; n=44), and with indeterminate luteal activity (n=7).

Day of Cycle	Cohort (n = 55)	ELA (n = 7)	NELA (n = 41)	Indeterminant (n = 7)
-14	15.52 [11.72, 19.32]	10.26 [2.84, 17.68]	12.85 [9.76, 15.94]	13.59 [5.99, 21.19]
-13	15.27 [11.02, 19.52]	8.07 [2.70, 13.44]	11.53 [8.68, 14.38]	12.74 [6.80, 18.68]
-12	15.51 [12.14, 18.88]	11.30 [1.30, 21.3]	14.02 [10.42, 17.62]	12.78 [7.96, 17.60]
-11	13.26 [10.29, 16.23]	9.05 [6.04, 12.06]	12.79 [9.63, 15.95]	12.71 [3.10, 22.32]
-10	16.89 [10.94, 22.84]	9.70 [6.92, 12.48]	11.04 [8.94, 13.14]	11.95 [0.58, 23.32]
-9	13.71 [10.17, 17.25]	9.46 [3.08, 15.84]	11.73 [8.84, 14.62]	11.71 [0.84, 22.58]
-8	13.96 [8.28, 19.64]	10.69 [5.9, 15.48]	9.47 [7.24, 11.70]	9.96 [2.71, 17.21]
-7	14.45 [11.42, 17.48]	10.28 [6.21, 14.35]	12.59 [9.48, 15.70]	12.33 [4.18, 20.48]
-6	13.48 [9.46, 17.50]	8.44 [3.58, 13.3]	10.60 [8.58, 12.62]	12.54 [4.52, 20.56]
-5	11.70 [7.27, 16.13]	19.37 [-9.33, 48.07]	9.10 [7.04, 11.16]	6.15 [3.49, 8.81]
-4	13.46 [9.32, 17.60]	10.90 [3.26, 18.54]	11.55 [7.82, 15.28]	8.6 [2.78, 14.42]
-3	14.22 [10.6, 17.84]	16.09 [-5.31, 37.49]	13.22 [8.69, 17.75]	20.96 [-2.74, 44.66]
-2	10.51 [6.41, 14.61]	12.30 [5.69, 18.91]	11.93 [8.62, 15.24]	12.00 [0.26, 23.74]
-1	13.01 [9.78, 16.24]	13.82 [2.00, 25.64]	14.03 [9.18, 18.88]	10.15 [3.47, 16.83]
0	24.32 [19.70, 28.94]	20.41 [12.34, 28.48]	17.29 [14.41, 20.17]	23.50 [10.74, 36.26]
1	14.49 [9.96, 19.02]	9.20 [6.95, 11.45]	11.38 [8.36, 14.40]	13.01 [2.12, 23.9]
2	15.66 [11.06, 20.26]	8.37 [-3.79, 20.53]	12.40 [9.40, 15.40]	12.56 [5.89, 19.23]
3	17.02 [12.48, 21.56]	5.22 [-2.76, 13.2]	11.46 [9.37, 13.55]	12.85 [0.99, 24.71]
4	15.87 [11.23, 20.51]	5.45 [2.29, 8.61]	13.12 [9.77, 16.47]	7.72 [1.66, 13.78]
5	13.22 [8.93, 17.51]	7.48 [-0.13, 15.09]	11.79 [9.12, 14.46]	10.55 [4.17, 16.93]
6	10.25 [7.13, 13.37]	6.12 [-1.01, 13.25]	11.28 [8.95, 13.61]	11.35 [0.47, 22.23]
7	11.40 [8.87, 13.93]	5.13 [2.15, 8.11]	12.16 [9.20, 15.12]	15.15 [8.34, 21.96]
8	13.55 [9.42, 17.68]	8.12 [4.24, 12.00]	12.54 [9.80, 15.28]	8.18 [2.22, 14.14]
9	14.26 [10.38, 18.14]	6.65 [-0.78, 14.08]	10.65 [7.95, 13.35]	6.10 [-0.17, 12.37]
10	10.85 [7.27, 14.43]	5.91 [-0.36, 12.18]	9.94 [7.47, 12.41]	8.53 [1.37, 15.69]
11	11.39 [6.47, 16.31]	6.85 [0.54, 13.16]	11.36 [8.62, 14.1]	9.35 [0.11, 18.59]
12	12.48 [9.09, 15.87]	7.29 [-2.27, 16.85]	13.25 [10.17, 16.33]	11.03 [4.07, 17.99]
13	10.50 [5.97, 15.03]	9.72 [-0.85, 20.29]	14.71 [11.00, 18.42]	17.20 [-6.72, 41.12]
14	12.55 [8.30, 16.80]	9.19 [2.73, 15.65]	13.36 [10.21, 16.51]	14.23 [5.17, 23.29]

Values are presented as mean [95% confidence interval] per group.

Supplemental Table 4. Estrone conjugates (E1C; ng/mg cr) in the entire cohort and in trainees with evidence of luteal activity (ELA; n=7), with no evidence of luteal activity (NELA; n=44), and with indeterminant luteal activity (n=7).

	Cohort (n = 55)	ELA (n = 7)	NELA (n = 41)	Indeterminant (n = 7)
Day of Cycle				
-14	8.74 [6.82, 10.66]	8.95 [3.26, 14.64]	8.37 [6.75, 9.99]	5.10 [2.00, 8.20]
-13	9.80 [6.96, 12.64]	10.57 [2.30, 18.84]	7.78 [6.29, 9.27]	5.15 [2.71, 7.59]
-12	9.15 [6.80, 11.50]	9.21 [3.50, 14.92]	8.14 [6.30, 9.98]	6.26 [3.68, 8.84]
-11	9.03 [6.46, 11.60]	9.68 [3.48, 15.88]	7.28 [5.71, 8.85]	5.54 [2.85, 8.23]
-10	9.29 [5.92, 12.66]	9.82 [5.22, 14.42]	7.19 [5.74, 8.64]	5.13 [2.78, 7.48]
-9	9.41 [6.69, 12.13]	9.60 [4.35, 14.85]	8.30 [6.81, 9.79]	4.84 [2.55, 7.13]
-8	8.49 [6.20, 10.78]	10.04 [3.95, 16.13]	7.87 [6.34, 9.40]	6.22 [0.81, 11.63]
-7	9.27 [6.20, 12.34]	11.01 [3.92, 18.10]	8.78 [7.28, 10.28]	5.17 [3.10, 7.24]
-6	8.51 [6.08, 10.94]	12.05 [4.17, 19.93]	7.93 [6.52, 9.34]	6.66 [3.26, 10.06]
-5	9.40 [5.84, 12.96]	10.23 [-3.76, 24.22]	8.20 [6.85, 9.55]	4.15 [2.12, 6.18]
-4	11.12 [7.44, 14.8]	11.96 [1.55, 22.37]	8.30 [6.58, 10.02]	5.51 [0.17, 10.85]
-3	8.22 [6.02, 10.42]	13.4 [5.16, 21.64]	9.32 [7.30, 11.34]	7.66 [-6.52, 21.84]
-2	11.07 [8.07, 14.07]	11.23 [4.37, 18.09]	9.16 [7.17, 11.15]	7.09 [1.23, 12.95]
-1	12.86 [9.00, 16.72]	11.87 [6.61, 17.13]	10.40 [8.23, 12.57]	7.00 [-2.21, 16.21]
0	25.94 [19.42, 32.46]	29.57 [13.06, 46.08]	16.43 [14.07, 18.79]	19.9 [9.42, 30.38]
1	12.06 [6.02, 18.10]	18.91 [7.50, 30.32]	9.97 [7.76, 12.18]	6.99 [3.16, 10.82]
2	11.58 [8.16, 15.00]	17.49 [2.13, 32.85]	9.99 [7.98, 12.00]	8.65 [4.12, 13.18]
3	10.72 [5.90, 15.54]	10.06 [2.09, 18.03]	9.97 [8.11, 11.83]	15.55 [-1.32, 32.42]
4	10.78 [7.46, 14.10]	15.00 [2.85, 27.15]	9.41 [7.38, 11.44]	8.48 [1.22, 15.74]
5	8.78 [5.93, 11.63]	10.24 [4.98, 15.50]	8.61 [6.97, 10.25]	9.26 [-2.55, 21.07]
6	8.19 [5.58, 10.80]	18.56 [-0.76, 37.88]	9.05 [7.14, 10.96]	9.48 [-5.33, 24.29]
7	10.03 [6.12, 13.94]	16.05 [3.27, 28.83]	9.08 [7.24, 10.92]	8.44 [-1.06, 17.94]
8	10.10 [6.25, 13.95]	21.36 [-0.41, 43.13]	8.92 [6.96, 10.88]	6.94 [1.77, 12.11]
9	8.64 [5.30, 11.98]	27.33 [-31.09, 85.75]	7.74 [5.70, 9.78]	6.69 [1.48, 11.9]
10	9.45 [4.71, 14.19]	17.77 [-3.65, 39.19]	7.78 [5.18, 10.38]	10.29 [-5.22, 25.8]
11	11.68 [3.66, 19.70]	21.69 [2.12, 41.26]	7.55 [5.83, 9.27]	6.34 [2.22, 10.46]
12	9.33 [6.01, 12.65]	14.31 [1.43, 27.19]	8.63 [7.03, 10.23]	6.08 [2.78, 9.38]
13	8.73 [5.55, 11.91]	11.96 [7.22, 16.70]	8.40 [7.18, 9.62]	6.74 [1.67, 11.81]
14	11.12 [8.06, 14.18]	10.64 [6.32, 14.96]	8.20 [6.4, 10.00]	7.69 [2.27, 13.11]

Values are presented as mean [95% confidence interval] per group.

Supplemental Table 5. Pregnanediol glucuronide (PdG; ng/mg cr) in the entire cohort and in trainees with evidence of luteal activity (ELA; n=7), with no evidence of luteal activity (NELA; n=44), and with indeterminant luteal activity (n=7).

	Cohort (n = 55)	ELA (n = 7)	NELA (n = 41)	Indeterminant (n = 7)
Day of Cycle				
-14	0.72 [0.14, 1.30]	0.34 [0.08, 0.60]	0.45 [0.34, 0.56]	0.35 [0.19, 0.51]
-13	0.63 [0.17, 1.09]	0.50 [0.25, 0.75]	0.43 [0.33, 0.53]	0.40 [0.03, 0.77]
-12	0.73 [-0.06, 1.52]	0.52 [0.19, 0.85]	0.41 [0.31, 0.51]	0.45 [0.22, 0.68]
-11	0.58 [0.09, 1.07]	0.73 [0.31, 1.15]	0.43 [0.29, 0.57]	0.35 [0.21, 0.49]
-10	0.66 [0.33, 0.99]	0.52 [0.18, 0.86]	0.49 [0.29, 0.69]	0.22 [0.00, 0.44]
-9	0.96 [0.11, 1.81]	0.90 [-0.02, 1.82]	0.48 [0.35, 0.61]	0.32 [0.14, 0.50]
-8	0.85 [0.02, 1.68]	0.59 [0.32, 0.86]	0.43 [0.31, 0.55]	0.33 [0.05, 0.61]
-7	1.14 [-0.13, 2.41]	0.58 [0.26, 0.9]	0.59 [0.32, 0.86]	0.35 [0.00, 0.70]
-6	0.74 [-0.09, 1.57]	0.62 [0.35, 0.89]	0.44 [0.31, 0.57]	0.35 [0.17, 0.53]
-5	0.72 [-0.14, 1.58]	0.38 [0.20, 0.56]	0.46 [0.3, 0.62]	0.28 [0.14, 0.42]
-4	0.95 [0.07, 1.83]	0.57 [0.26, 0.88]	0.43 [0.34, 0.52]	0.43 [0.05, 0.81]
-3	0.90 [-0.27, 2.07]	0.52 [0.35, 0.69]	0.46 [0.34, 0.58]	0.36 [0.19, 0.53]
-2	0.72 [0.14, 1.30]	0.75 [0.28, 1.22]	0.41 [0.31, 0.51]	0.37 [-0.08, 0.82]
-1	0.63 [0.22, 1.04]	0.77 [0.37, 1.17]	0.4 [0.33, 0.47]	0.37 [0.14, 0.60]
0	1.36 [0.47, 2.25]	1.04 [0.42, 1.66]	0.56 [0.44, 0.68]	0.92 [-0.13, 1.97]
1	1.72 [0.36, 3.08]	1.00 [0.24, 1.76]	0.43 [0.34, 0.52]	0.54 [-0.27, 1.35]
2	1.02 [0.34, 1.70]	1.14 [-0.37, 2.65]	0.41 [0.3, 0.52]	0.24 [0.00, 0.48]
3	1.24 [0.05, 2.43]	1.59 [-0.48, 3.66]	0.48 [0.33, 0.63]	0.56 [0.27, 0.85]
4	1.08 [0.18, 1.98]	1.58 [-0.54, 3.70]	0.47 [0.35, 0.59]	0.50 [0.06, 0.94]
5	0.71 [0.13, 1.29]	2.21 [0.39, 4.03]	0.55 [0.31, 0.79]	0.73 [0.02, 1.44]
6	0.91 [0.04, 1.78]	1.61 [0.67, 2.55]	0.41 [0.32, 0.5]	0.81 [-0.82, 2.44]
7	0.68 [0.04, 1.32]	1.24 [0.03, 2.45]	0.43 [0.32, 0.54]	0.91 [-0.38, 2.20]
8	0.61 [0.13, 1.09]	0.80 [0.25, 1.35]	0.41 [0.3, 0.52]	0.69 [-0.49, 1.87]
9	0.86 [-0.20, 1.92]	1.28 [-0.19, 2.75]	0.38 [0.28, 0.48]	0.55 [-0.23, 1.33]
10	0.75 [0.23, 1.27]	1.03 [0.24, 1.82]	0.42 [0.25, 0.59]	0.29 [0.05, 0.53]
11	0.78 [0.26, 1.30]	1.64 [0.66, 2.62]	0.43 [0.28, 0.58]	0.36 [0.08, 0.64]
12	0.63 [0.06, 1.20]	0.74 [0.14, 1.34]	0.42 [0.28, 0.56]	0.35 [0.09, 0.61]
13	0.78 [-0.18, 1.74]	0.81 [-0.04, 1.66]	0.39 [0.29, 0.49]	0.43 [0.03, 0.83]
14	0.38 [0.27, 0.49]	0.67 [0.16, 1.18]	0.43 [0.29, 0.57]	0.36 [0.22, 0.50]

Values are presented as mean [95% confidence interval] per group.

Supplemental Table 6. Changes in body mass and composition and self-reported sleep from baseline to post-BCT among trainees excluded from the study and those in the overall included cohort.

	Excluded (n = 49)	Cohort (n = 53)	p-value
ΔBody Mass (kg)	0.9 [0.1, 1.7]	1.1 [0.3, 1.9]	0.72
ΔBMI (kg·m ⁻²)	0.3 [-0.02, 0.6]	0.2 [-0.1, 0.6]	0.82
ΔFat Free Mass (kg)	3.8 [3.3, 4.3]	3.1 [2.7, 3.5]	0.04
ΔFat Mass (kg)	-1.9 [-2.6, -1.3]	-1.7 [-2.4, -1.0]	0.70
Δ% Body Fat	-4.0 [-4.7, -3.3]	-3.3 [-4.0, -2.6]	0.17
ΔSleep per night (hrs)	-0.7 [-1.2, -0.2]	-0.7 [-1.0, -0.3]	0.94

Values are presented as mean [95% confidence interval] per group.

Supplemental Table 7. Fasted, rested serum biomarkers in trainees excluded from the study, the overall included cohort, and those with evidence of luteal activity (ELA), those with no evidence of luteal activity (NELA), and those with indeterminant luteal activity.

	Excluded (n = 49)	Cohort (n = 55)	ELA (n=7)	NELA (n=41)	Indeterminant (n=7)
Leptin (ng/mL)					
Baseline	13.0 [10.7, 15.2]	15.4 [12.7, 18.2]	10.7 [4.6, 16.8]	15.5 [12.1, 18.9]	19.3 [10.2, 28.3]
2	11.0 [9.2, 12.8]	13.8 [11.7, 15.9]	10.7 [5.6, 15.7]	14.6 [12.0, 17.3]	12.8 [6.7, 19.0]
4	14.9 [12.5, 17.3]	17.0 [14.7, 19.4]	15.9 [6.7, 25.1]	17.7 [15.0, 20.5]	14.3 [7.2, 21.4]
6	17.4 [14.8, 20.0]	18.1 [15.3, 20.9]	13.7 [5.1, 22.2]	19.6 [16.2, 22.9]	12.0 [9.3, 14.7]
8	16.8 [14.1, 19.4]	16.9 [14.4, 19.5]	12.8 [3.8, 21.8]	18.1 [15.2, 21.0]	10.4 [2.0, 18.8]
Post-BCT	20.1 [17.2, 23.1]	22.7 [19.6, 25.7]	15.6 [6.8, 24.5]	25.0 [21.5, 28.6]	17.3 [8.2, 26.5]
FT3 (pg/mL)					
Baseline	3.0 [1.73, 4.3]	3.0 [2.7, 3.2]	3.2 [1.8, 4.6]	2.9 [2.7, 3.2]	3.3 [2.8, 3.7]
2	2.9 [2.4, 3.5]	2.8 [2.5, 3.0]	2.9 [1.7, 4.1]	2.7 [2.4, 3.0]	3.1 [2.4, 3.7]
4	3.03 [2.1, 4.0]	3.0 [2.8, 3.1]	3.0 [2.4, 3.7]	2.9 [2.7, 3.2]	3.1 [2.7, 3.4]
6	3.2 [2.1, 4.3]	2.8 [2.5, 3.0]	3.0 [1.2, 4.8]	2.7 [2.4, 2.9]	3.0 [1.9, 4.1]
8	3.4 [2.3, 4.5]	2.8 [2.6, 3.0]	3.1 [2.2, 3.9]	2.8 [2.5, 3.0]	3.0 [2.2, 3.8]
Post-BCT	3.12 [2.1, 4.2]	3.0 [2.8, 3.2]	3.0 [2.2, 3.8]	3.0 [2.8, 3.2]	3.1 [2.6, 3.6]
IGF-1 (ng/mL)					
Baseline	196.7 [182.4, 211.1]	197.6 [183.7, 211.6]	228.3 [170.1, 286.4]	198.2 [181.9, 214.5]	168.2 [142.5, 193.9]
1	197.4 [181.0, 213.7]	190.9 [176.5, 205.2]	198.4 [118.9, 277.8]	193.0 [176.1, 210.0]	172.3 [134.3, 210.4]
2	156.2 [143.8, 168.6]	165.9 [151.7, 180.0]	182.0 [126.7, 237.3]	173.4 [157.4, 189.4]	113.2 [102.8, 123.7]
3	206.7 [190.9, 222.4]	199.5 [184.4, 214.5]	228.8 [195.0, 262.5]	198.4 [180.2, 216.6]	176.1 [123.5, 228.6]
4	245.7 [228.4, 263.0]	237.0 [221.1, 252.8]	261.8 [217.0, 306.5]	243.6 [224.9, 262.3]	181.6 [160.3, 202.9]
5	214.3 [199.4, 229.2]	213.4 [198.7, 228.2]	232.4 [186.3, 278.5]	221.9 [205.1, 238.8]	156.2 [139.2, 173.2]
6	194.8 [180.2, 209.3]	187.6 [173.2, 201.9]	186.1 [148.9, 223.4]	193.7 [177.0, 210.4]	143.6 [118.2, 169.0]
7	221.9 [207.2, 236.7]	206.4 [192.5, 220.4]	205.2 [167.5, 242.9]	213.4 [196.7, 230.2]	164.3 [146.1, 182.5]
8	220.6 [205.0, 236.2]	201.2 [188.0, 214.3]	201.5 [151.8, 251.2]	206.2 [191.4, 221.0]	156.5 [116.2, 196.8]
Post-BCT	264.0 [246.7, 281.4]	220.8 [203.9, 237.6]	237.3 [181.2, 293.4]	224.1 [202.8, 245.5]	189.1 [170.8, 207.5]
Cortisol (ug/dL)					
Baseline	17.5 [16.1, 18.8]	17.3 [16.1, 18.4]	14.2 [12.6, 15.8]	18.3 [16.9, 19.8]	15.2 [9.6, 20.8]
1	16.6 [15.3, 17.9]	15.9 [14.6, 17.2]	13.0 [9.7, 16.3]	17.6 [16.1, 19.0]	13.3 [8.8, 17.8]
2	16.7 [15.6, 17.9]	16.8 [15.7, 18.0]	13.0 [10.8, 15.1]	18.2 [17.0, 19.4]	12.6 [10.0, 15.2]
3	15.1 [14.0, 16.3]	15.4 [14.1, 16.6]	11.6 [8.1, 15.0]	16.2 [15.0, 17.4]	13.0 [10.2, 15.8]
4	16.3 [15.3, 17.2]	16.8 [15.6, 18.0]	12.8 [9.9, 15.7]	17.2 [16.1, 18.2]	14.5 [11.7, 17.3]
5	15.9 [14.8, 17.0]	16.1 [15.0, 17.3]	11.8 [9.1, 14.5]	16.9 [15.7, 18.1]	13.8 [11.4, 16.3]
6	15.5 [14.5, 16.5]	17.0 [15.7, 18.4]	13.6 [10.9, 16.3]	15.8 [14.7, 16.9]	14.7 [9.4, 20.0]
7	18.0 [17.0, 18.9]	18.0 [16.6, 19.3]	14.2 [9.9, 18.5]	18.7 [17.7, 19.7]	16.3 [13.7, 19.0]
8	18.6 [17.6, 19.5]	18.7 [17.3, 20.1]	17.3 [14.0, 20.5]	18.9 [17.9, 19.9]	16.8 [9.6, 24.0]
Post-BCT	15.7 [14.4, 16.9]	16.5 [15.3, 17.6]	13.7 [8.8, 17.4]	16.3 [14.8, 17.9]	14.0 [11.2, 16.7]
T3 (ng/dL)					
Baseline	83.0 [51.6, 114.5]	91.7 [85.8, 97.6]	99.0 [77.5, 120.5]	89.2 [82.1, 96.3]	98.3 [78.5, 118.1]
2	82.2 [60.2, 104.2]	86.0 [81.1, 90.8]	88.8 [76.7, 100.9]	83.9 [77.6, 90.1]	93.2 [81.2, 105.1]
4	91.7 [66.1, 117.4]	95.0 [90.8, 99.2]	103.6 [87.4, 119.9]	93.7 [88.7, 98.7]	93.6 [80.2, 107.0]
6	90.9 [67.9, 113.8]	89.6 [85.1, 94.1]	96.7 [70.3, 123.0]	87.3 [82.4, 92.2]	98.3 [80.5, 116.0]
8	94.3 [62.7, 126.0]	89.7 [84.5, 94.8]	91.0 [63.5, 118.5]	89.8 [83.6, 96.0]	87.9 [67.9, 107.9]
Post-BCT	95.0 [58.3, 131.7]	95.6 [90.9, 100.4]	99.2 [81.7, 116.7]	95.6 [89.7, 101.5]	92.9 [77.7, 108.2]
T4 (ug/dL)					
Baseline	7.1 [4.8, 9.4]	6.9 [6.5, 7.3]	6.8 [4.9, 8.7]	6.9 [6.4, 7.4]	7.1 [5.9, 8.3]
2	5.4 [4.2, 6.6]	5.6 [5.3, 6.0]	4.7 [3.7, 5.8]	5.8 [5.3, 6.2]	5.7 [5.1, 6.2]
4	5.4 [4.4, 6.4]	5.6 [5.2, 5.9]	5.1 [4.3, 5.9]	5.6 [5.2, 6.0]	5.7 [4.9, 6.4]
6	5.0 [3.9, 6.2]	5.5 [5.1, 5.8]	4.7 [2.2, 7.1]	5.6 [5.3, 6.0]	5.3 [3.8, 6.8]
8	5.6 [3.9, 7.2]	5.6 [5.3, 5.8]	4.7 [3.4, 5.9]	5.7 [5.4, 6.0]	5.9 [4.8, 7.0]
Post-BCT	5.8 [4.4, 7.3]	5.8 [5.5, 6.0]	5.0 [3.8, 6.1]	5.9 [5.6, 6.2]	5.6 [5.0, 6.2]
FT4 (ng/dL)					
Baseline	1.0 [0.7, 1.2]	1.0 [0.9, 1.0]	0.9 [0.7, 1.0]	1.0 [0.9, 1.1]	1.0 [0.9, 1.0]
2	0.8 [0.7, 0.9]	0.9 [0.8, 0.9]	0.8 [0.6, 0.9]	0.9 [0.8, 1.0]	0.9 [0.8, 0.9]
4	0.8 [0.7, 1.0]	0.8 [0.8, 0.9]	0.7 [0.6, 0.8]	0.9 [0.8, 0.9]	0.9 [0.8, 0.9]
6	0.9 [0.7, 1.0]	0.9 [0.8, 0.9]	0.7 [0.5, 0.8]	0.8 [0.7, 1.0]	0.9 [0.8, 0.9]
8	0.9 [0.7, 1.1]	0.9 [0.8, 0.9]	0.7 [0.6, 0.8]	0.9 [0.8, 0.9]	0.9 [0.8, 0.9]
Post-BCT	0.9 [0.8, 1.0]	0.9 [0.8, 0.9]	0.8 [0.7, 0.9]	0.9 [0.8, 1.0]	0.9 [0.9, 1.0]

Values are presented as mean [95% confidence interval] per group for leptin, free triiodothyronine (FT3), Insulin-like growth factor (IGF-1), cortisol, triiodothyronine (T3), thyroxine (T4), and free thyroxine (FT4).

Supplemental power analysis:

Initially our study was designed and powered to determine the prevalence of HPO axis suppression during BCT, to determine the relationship between HPO axis suppression and biomarkers of bone metabolism, and to determine the relationship between low energy availability and HPO axis suppression. We were limited to recruiting from one incoming BCT class at one Army base. This study is a sub-study of a four-year prospective observation study. Based on enrollment from this ongoing study, we understood that we could likely enroll a convenience sample of approximately 120 women in a single BCT class. We assumed a 20-30% dropout rate. We estimated that 50% of women would have no evidence of luteal activity or shortened luteal phases and 50% would have healthy reproductive function.

The power analysis to test the hypothesis that HPO axis suppression is related to bone metabolism was based on an assumed detectable size of longitudinal mean CTX change of 0.085 ng/ml within our assumed ~50% of women with reproductive dysfunction. We used a 5% alpha and assumed between-group difference in the longitudinal mean changes (i.e., interaction) of 0.10 ng/ml. This calculation was based the estimated standard deviation of CTX change = 0.16 ng/ml shown by a recent study of changes in bone turnover markers in women during BCT¹⁴. Using these assumptions, a sample size of 100 women would give us >85% power to detect a difference between groups.

We also completed a power analysis for the hypothesis that energy availability will be lower among those with HPO axis suppression compared to those with healthy reproductive function. To power this aim of the study we used previously published data reporting elite athletes with suppressed reproductive function had a triiodothyronine (T3) level of 1.4nmol·L⁻¹ compared to 1.6 with a standard deviation of 0.2nmol·L⁻¹ in those with normal reproductive function⁵. Using these data and a 5% alpha, we would have 95% power to detect a difference in T3 between 23 women with HPO axis suppression and 23 without HPO axis suppression. Therefore, we believed our sample size of 100 was more than adequate to power this aim.

However, given that we identified zero women with healthy reproductive function, we could not test our original hypotheses.

Supplemental methods:

To be categorized as ELA, profiles had to meet the following criteria at any point during BCT¹⁵: 1) Adequate rise in PdG determined using the Kassam et al. validated algorithm that locates the five nadir days using moving averages. A 3-fold increase in PdG concentrations above the nadir for ≥3 consecutive days was considered an adequate rise. If one of three days was missing during a suspected PdG rise, we used simple linear interpolation; 2) FSH surge ≥3 standard deviations of the five nadir days using moving averages occurring ≤4 days before, on the day of, or one day after the first day of a sustained PdG rise; 3) LH surge ≥3 standard deviations of the five nadir days using moving averages occurring ≤4 days before, on the day of, or one day after the first day of a sustained PdG rise; and 4) using moving averages, a rise in E1c ≥3 standard deviations of the five nadir days during the follicular phase.