

Controls (n=23)							Meditators (n=26)					
	SOL(min)	N1 (min)	N2 (min)	N3 (min)	ROL (min)	REM (min)	SOL(min)	N1 (min)	N2 (min)	N3 (min)	ROL (min)	REM (min)
Sleep architecture (Whole night)	7.72±3.72	17.66±8.43	51.30±10.92	9.23±7.60	100.37±53.17	21.81±7.10	6.58±7.3	12.71±8.98*	41.38±12.08**	15.16±8.95**	66.30±26.18**	30.74±8.53**
Sleep stages (sleep cycle)	N2 (min)	N2 (%)	N3(min)	N3 (%)	REM (min)	REM (%)	N2(min)	N2 (%)	N3 (min)	N3 (%)	REM (min)	REM (%)
First sleep cycle	43.86±6.38	48.96±4.88	24.82±3.43	26.36±3.19	23.76±3.19	23.0±4.04	26.36±2.53**	32.13±3.46**	29.28±3.22	34.35±3.77	26.57±3.70	29.34±2.57
Second sleep cycle	32.30±4.79	34.15±4.50	20.15±3.75	24.92±4.42	33.69±6.36	32.44±4.20	22.98±4.50	22.78±3.78	31.71±3.22*	34.96±3.85*	44.40±7.56	41.47±3.87
Third sleep cycle	31.86±5.78	36.92±5.85	2.60±0.15	8.87±2.28	20.78±4.15	23.35±3.85	27.01±5.30	24.02±4.16	18.75±3.00**	18.20±3.32**	54.80±10.72**	40.88±4.69**

Values in Mean and SD, ANOVA showed less N2 and higher N3 and REM sleep state in meditators. During various sleep cycles, N3 was high in second and third sleep cycle, whereas, REM was high in third sleep cycle in meditators when compared to controls. *p<0.05. **p<0.001. N2=: Sleep stage 2, N3: Sleep stage 3, REM: Rapid Eye Movement, SOL: Sleep Onset latency, ROL: REM Onset Latency

Table 1: Details of duration and percentage of N2, N3 and REM during whole night and during different sleep cycles between controls and meditators.

Sleep Cycles		Controls (n=23)			Meditators (n=26)			Group Interaction	Sleep stage Interaction	ES (Partial eta Square)
		N2	N3	REM	N2	N3	REM			
First Cycle	SDNN (ms)	88.20±20.62	75.91±15.02	97.17±24.59	131.11±24.79	171.79±18.05	94.73±29.56	(1,48)=0.98,p=0.33	(2,48)=0.66,p=0.49	0.047
	RMSSD	92.21±32.27	77.31±24.22	111.34±42.93	166.32±38.78	133.01±29.11	93.68±51.60	(1,48) = 0.14,p=0.43	(2,48)=0.87, p=0.32	0.031
	NN50 (ms)	113.46±39.40	176.9±65.84	212.07±70.67	178.11±47.67	216.22±79.13	221.88±84.93	(1, 48) = 0.25, p=0.61	(2,48)=2.49, p=0.09	0.013
	PNN50 (%)	25.66±6.86	24.56±7.03	27.17±5.96	31.74±8.25	30.25±8.46	26.63±7.16	(1,48)= 0.21, p=0.64	(2,48)=0.67, p=0.37	0.011
	HR (beats /min)	64.64±4.09	63.44±3.22	63.73±3.42	65.04±3.54	64.14±2.79	64.88±2.97	(1, 48) = 0.026, p=0.87	(2,48)=0.58, p=0.56	0.001
Second Cycle	SDNN (ms)	82.50±12.72	70.33±11.15	87.75±12.39	116.91±16.10	93.96±14.11	103.64±15.68	(1, 48) = 1.96, p=0.18	(2,48)=3.12 ,p=0.05	0.151
	RMSSD	54.18±12.07	49.49±12.49	72.79±13.09	101.46±15.27	83.73±15.80*	87.91±16.56	(1,48) =3.02, p=0.11	(2,48) =0.79,p=0.41	0.216
	NN50 (ms)	150.00±61.98	204.20±67.58	190.20±89.98	209.62±49.00	147.12±53.43	200.37±71.14	(1, 48)= 0.003, p=0.95	(2.48) =0.72,p=0.49	0.081
	PNN50 (%)	29.97±7.90	32.64±7.90	28.13±11.45	31.44±6.24	25.69±6.24	30.92±9.05	(1,48)= 0.003, p=0.98	(2,48)=0.011 ,p=0.98	0.082

	HR (beats /min)	62.16±2.34	61.38±2.98	101.53±31.02	62.01±2.97	61.99±3.64	60.29±40.23	(1,48)= 0.53, p=0.48	(2,48)=0.59, p=0.47	0.046
Third Cycle	SDNN (ms)	97.84±24.43	92.34±29.89	103.72±54.86	88.61±19.95	106.35±24.41	133.63±30.32	(1,48)= 0.06, p=0.80	(2,48) =0.89,p=0.40	0.008
	RMSSD	69.61±32.49	68.77 ±34.86	67.58±72.24	85.26±26.53	98.46±28.46	147.17±58.58	(1,48) = 0.52, p=0.48	(2,48)=0.77, p=0.44	0.062
	NN50 (ms)	213.09±81.32	134.5±61.50	183.32±103.78	316.25±99.60	249.50±75.19	499.0±127.13*	(1,48) = 2.94, p=0.12	(2,48)=2.56, p=0.16	0.269
	PNN50 (%)	32.29±9.98	35.62±10.34	49.9±12.7	41.09±12.23	33.39±12.67	83.33±10.28*	(1,48)= 3.13, p=0.11	(2,48)=15.17, p=0.05	0.282
	HR (beats /min)	63.4±4.43	64.61±3.91	63.21±4.13	60.13±3.62	59.08±3.19	57.94±3.37	(1,48) = 0.82, p=0.39	(2,48)=1.34, p=0.29	0.09

Values are represented as the mean and SE. Statistical analysis was carried out using analysis of variance with repeated measures and 't' test for within and between groups respectively. *p <0.016 after Bonferroni correction for 't' test.

HR: Heart Rate, ES: Effect Size of Meditation Practice. SDNN: Standard Deviation of NN Interval, RMSSD: Root Mean Square of Standard Deviation of NN, NN50: NN Interval More than 50msec, PNN50: Percentage of NN50, HR: Heart Rate.

Table 2: Time domain HRV parameters and heart rate during N2, N3 and REM sleep states across sleep cycles among controls and Vipassana meditators.

Sleep Cycles		Controls (n=23)			Meditators (n=26)			Group Interaction	Sleep State Interaction	ES (Partial Eta Square)
		N2	N3	REM	N2	N3	REM			
First Cycle	LF power (ms ²)	7600.81.0 ± 1755.53	3560.63 ± 848.01	3830.09 ± 1432.70	2349.90 ± 1460.69	1286.95 ± 705.59*	2315.44 ± 1192.07	(1,48) =1.44, p=0.24	(2,48)=1.711 ,p=0.2	0.067
	HF power (ms ²)	102439.01 ± 61751.10	6791.47 ± 2021.93	1926.43 ± 2076.82	4555.61 ± 51380.02	2940.05 ± 1674.85	4031.67 ± 1728.01	(1,48)=2.27 ,p=0.14	(2,48)=1.94 ,p=0.17	0.084
	LF nu	52.57±7.24	37.76±4.70	57.00±4.96	39.45±6.0 2*	26.09±3.91	49.99±4.12	(1,48)= 2.30, p=0.14	(2,48)=1.68 ,p=0.02	0.104
	HF nu	29.41±6.28	49.50±5.30	33.11±4.08	50.67±5.2 3*	63.58 ±4.41	45.81±3.400 *	(1,48)=184.48 ,p=0.00	(2,48)=1.39, p=0.04	0.081
	LF/HF ratio	2.32±0.38	0.98±0.24	1.75±0.19	0.93±0.32*	0.49±0.20	1.12 ±0.15*	(1,48) = 3.50, p=0.05	(2,48)=0.068, p=0.003	0.149
Second Cycle	LF power (ms ²)	3800.72 ± 650.15	2779.68 ± 456.95	2105.13 ± 2002.07	1779.86 ± 513.99	716.02 ± 361.25	4597.60 ± 1582.78	(1,48) = 0.08, p=0.77	(2,48)=1.38, p=0.26	0.087
	HF power (ms ²)	1882.79 ±592.92	1470.50 ± 413.29	1984.61 ± 859.34	1458.36 ± 468.75	1316.68 ±326.73	2487.41 ± 679.36	(1,48) =1.10, p=0.31	(2,48) =1.16,p=0.32	0.091
		59.74±9.22	63.60±5.68	50.65±8.26	52.20±7.2	30.28±4.49*	51.11±6.53	(1,48)=0.21,	(2,48)=0.21	

	LF nu				9*			p=0.01	,p=0.02	0.175
	HF nu	28.08±8.40	27.98±5.80	37.30±5.71	43.36±6.64*	64.93±4.58*	47.59±4.52*	(1,48)=4.00, p=0.03	(2,48)=0.56 ,p=0.04	0.002
	LF/HF ratio	2.38±1.09	2.67±0.33	1.95±0.55	2.31±0.86	0.57±0.26*	1.11±0.43*	(1,48)=0.87, p=0.025	(2,48)=0.62 ,p=0.05	0.002
Third Cycle	LF power (ms²)	2289.46 ± 1384.46	2370.61 ± 2021.67	2918.28 ± 8482.15	2677.00 ± 1130.41	3498.97 ± 1643.34	10288.71± 6925.64	(1,48)= 0.43, p=0.52	(2,48)=0.85, p=0.39	0.034
	HF power (ms²)	1537.39 ± 2687.82	1531.81 ± 3127.13	2110.61 ± 12282.7	4008.74 ± 2194.59	5204.36 ± 2553.29	14480.38± 10028.8	(1,48) =0.56, p=0.47	(2,48)=0.67, p=0.45	0.066
	LF nu	60.38±10.84	61.09±11.25	57.20±6.57	48.20±8.58	41.64±9.91	43.21±5.36	(1,48)=0.40, p=0.54	(2,48)=1.50, p=0.006	0.048
	HF nu	33.69±9.58	33.86 ±10.54	39.00±6.14	46.36±7.82	52.10±8.61*	51.98±5.01*	(1,48)=97.49, p=0.039	(2,48)=0.98, p=0.002	0.051
	LF/HF ratio	2.23±1.32	3.30±0.98	1.86±0.39	2.19±1.08	0.96±0.80*	0.91±0.31*	(1,48) =0.30, p=0.03	(2,48)=0.39, p=0.04	0.067

Values are represented as the mean and SE. Statistical analysis was carried out using analysis of variance with repeated Measures and 't' test for within and between groups respectively. *p <0.016 after Bonferroni correction for 't' test. Meditators showed increased HFnu and decreased LF/HF ratio in N3 and REM sleep states when compared to controls.

ES: Effect Size of Meditation Practice, LF: Low Frequency, HF: High Frequency, LFnu: Normalised LF Power, HFnu: Normalised HF Power, N2: Stage 2 Sleep, N3: Stage 3 Sleeps, REM: Rapid Eye Movement.

Table 3: Details of LF power, HF power, LF nu, HFnu and LF/HF ratio during N2, N3 and REM sleep states across sleep cycles among controls and Vipassana meditators.