

Table S1 Sociodemographic and lifestyle characteristics

Qualitative variables	NH group (n=23)	CM group (n=23)
Gender		
Female	96.0 (22)	96.0 (22)
Male	4.0 (1)	4.0 (1)
Skin color		
White	61.0 (14)	26.0 (6)
Brown	39.0 (9)	70.0 (16)
Black	0.0 (0)	4.0 (1)
Marital status		
Married	35.0 (8)	26.0 (6)
Divorced	0.0 (0)	4.0 (0)
Single	65.0 (15)	70.0 (16)
Education		
Some primary	0.0 (0)	4.0 (1)
Secondary	4.0 (1)	22.0 (5)
Higher	57.0 (13)	30.0 (7)
Some higher	39.0 (9)	43.0 (10)
Body mass index		
Underweight	17.0 (4)	4.0 (1)
Normal	39.0 (9)	65.0 (15)
Overweight	26.0 (6)	17.0 (4)
Obese	17.0 (4)	13.0 (3)
Employment situation		
Student	26.0 (6)	35.0 (8)
Self-employed	48.0 (11)	17.0 (4)
Salaried	22.0 (5)	30.0 (7)
Unemployed	4.0 (1)	17.0 (4)
Other chronic diseases	17.0 (4)	9.0 (2)
Respiratory changes	35.0 (8)	4.0 (1)
Physical activity level		
Low	52.2 (12)	78.3 (18)
Moderate	30.4 (7)	17.4 (4)
High	17.4 (4)	4.3 (1)
Smoking		
Never smoked	91.3 (21)	95.7 (22)
Former smoker	8.7 (2)	0.0 (0)
Current smoker	0.0 (0)	4.3 (1)
Alcohol consumption		
Rarely	38.7 (9)	51.6 (12)
Once a month	51.6 (12)	34.4 (8)
1-4 times a month	8.7 (2)	12.9 (3)

Data presented as n (%), unless otherwise specified.

Values expressed as absolute and relative frequencies.

CM = chronic migraine; NH = non-headache.

Table S2 Qualitative clinical characteristics of migraine attacks among affected individuals

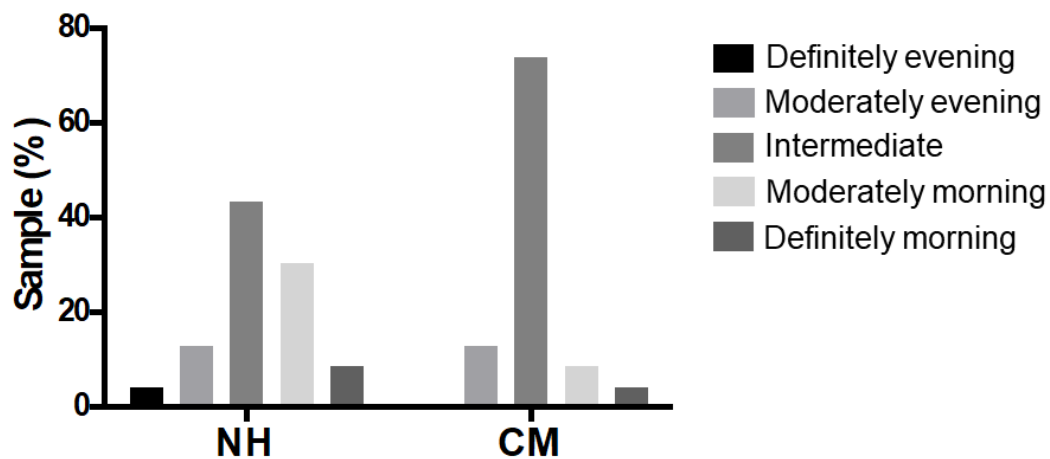
Qualitative variables	CM group (n=23)
Migraine onset	
Between 1 and 3 years	17.4 (4)
Between 3 and 10 years	17.4 (4)
> 10 years	65.2 (15)
Pain characteristic [†]	
Pulsating	82.6 (20)
Burning	13.0 (3)
Pressure	47.8 (11)
Shock	4.3 (1)
Stitch	34.8 (8)
Pain intensity	
Severe	52.2 (12)
Moderate	47.8 (11)
Mild	0.0 (0)
Progression of pain intensity	
Growing	82.6 (19)
Constant	17.4 (4)
Associated symptoms [†]	
Nausea	87.0 (20)
Emesis	56.5 (13)
Photophobia	87.0 (20)
Phonophobia	100.0 (23)
Osmophobia	82.6 (19)
Dizziness	34.8 (8)
Reaction to pain	
Prefers to be in a dark and quiet place	82.6 (19)
Prefers walking or exercising	13.0 (3)
Has no preference	4.3 (1)
Crisis duration	
≤ 4 hours	17.4 (4)
4-6 hours	8.7 (2)
6-10 hours	4.3 (1)
10-12 hours	4.3 (1)
12-24 hours	26.1 (6)
>24 hours	39.1 (9)
Triggering factors [†]	
Foods	73.9 (17)
Fasting	82.6 (19)
Odors	87.0 (20)
Alcoholic beverages	52.2 (12)
Stress or anxiety symptoms	87.0 (20)
Not enough sleep	82.6 (19)
Too much sleep	43.5 (10)
Menstruation [‡]	90.9 (20)
Too much sun	73.9 (17)

Data presented as n (%), unless otherwise specified.

CM = chronic migraine.

[†] The sum of values exceeds 100% as there was more than one aspect per individual.[‡] Only women were considered.

Figure S1 Chronotype assessment of individuals with and without chronic migraine



Results expressed as relative frequency, considering the NH (N = 23) and CM (N = 23) groups. CM = chronic migraine; NH = non-headache.

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Table S3 Components of the Pittsburgh Sleep Quality Index (PSQI)

	NH (n=23) (mean ± SD)	CM (n=23) (mean ± SD)	p-value
Component 1: Sleep quality	1.04±0.56	1.96±0.98	< 0.001***
Component 2: Sleep latency	0.83±0.78	1.65±0.98	< 0.01**
Component 3: Sleep duration	0.26±0.54	0.74±0.75	0.02*
Component 4: Habitual sleep efficiency	0.13±0.34	0.52±0.95	0.07
Component 5: Sleep disorders	1.39±0.50	1.78±0.60	0.31
Component 6: Use of sleeping medication	0.35±1.47	0.26±0.62	0.47
Component 7: Daytime dysfunction	1.17±0.65	1.83±0.78	0.05
Total PSQI	5.17±2.31	8.74±2.60	< 0.001***

CM = chronic migraine; NH = non-headache.

Mann-Whitney *U* test; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table S4 Linear regression analysis between actimetric variables and symptoms of state anxiety in individuals with and without chronic migraine

Activity/rest rhythm	STAI-S (+)				STAI-S (-)				STAI-S (total)			
	EST	SE	R ²	p	EST	SE	R ²	p	EST	SE	R ²	p
Interaction between variables												
MESOR [†]	-0.22	0.15	0.11	0.14	0.09	0.14	0.07	0.52	-0.13	0.21	0.08	0.52
Amplitude [†]	-0.13	0.15	0.06	0.37	0.05	0.14	0.04	0.70	-0.08	0.21	0.07	0.69
Acrophase	-0.00	0.02	0.06	0.81	0.01	0.01	0.08	0.43	0.01	0.02	0.08	0.62
%V	-0.14	0.16	0.08	0.39	0.02	0.14	0.07	0.90	-0.11	0.23	0.07	0.63
L5 [†]	-0.17	0.27	0.05	0.53	0.03	0.25	0.03	0.90	-0.14	0.37	0.07	0.71
M10 [†]	-0.14	0.10	0.13	0.16	0.08	0.10	0.10	0.42	-0.07	0.15	0.07	0.65
IS	0.34	10.78	0.05	0.97	-1.44	9.13	0.10	0.87	-0.41	15.01	0.09	0.97
IV	14.52	12.47	0.13	0.25	-1.86	11.02	0.09	0.86	8.28	18.35	0.07	0.65
AR	9.22	11.19	0.08	0.41	4.60	10.00	0.02	0.64	8.29	16.02	0.07	0.60
AUC _{Activity}	000.0	0.000	0.06	0.61	0.000	0.000	0.01	0.70	0.000	0.000	0.07	0.47
%AUC _{4h}	0.123	0.478	0.06	0.80	-0.377	0.421	0.03	0.38	-0.205	0.678	0.06	0.76
%AUC _{Sleep}	-0.171	0.504	0.06	0.74	-0.239	0.447	0.01	0.59	-0.070	0.715	0.06	0.92
CVAON	1.710	16.751	0.07	0.92	-4.994	14.637	0.06	0.73	-1.477	23.327	0.11	0.95
CVAOF	44.544	45.546	0.08	0.33	16.577	40.680	0.02	0.69	68.575	64.366	0.09	0.29
CFI	-0.120	25.207	0.09	1.00	-22.67	22.435	0.03	0.32	-33.752	35.434	0.11	0.35
SRI	-0.139	0.119	0.09	0.25	-0.035	0.108	0.01	0.74	-0.222	0.168	0.10	0.19
fSoD	-6.236	14.330	0.06	0.67	-1.056	12.694	0.02	0.93	-5.002	20.292	0.07	0.81
k _{RA}	-20.411	46.434	0.07	0.66	-15.33	41.398	0.01	0.71	-7.872	66.308	0.06	0.91
CM interference [‡]												
MESOR [†]	0.18	0.16	0.11	0.27	-0.02	0.16	0.07	0.90	0.16	0.23	0.08	0.48
Amplitude [†]	0.13	0.17	0.06	0.45	-0.02	0.16	0.04	0.89	0.11	0.24	0.07	0.64
Acrophase	0.01	0.02	0.06	0.76	-0.02	0.02	0.08	0.18	-0.02	0.03	0.08	0.43
%V	0.08	0.20	0.08	0.66	0.14	0.17	0.07	0.42	0.21	0.28	0.07	0.45
L5 [†]	0.12	0.37	0.05	0.74	0.05	0.35	0.03	0.89	0.17	0.51	0.07	0.74
M10 [†]	0.06	0.13	0.13	0.63	0.03	0.12	0.10	0.81	0.09	0.19	0.07	0.63
IS	-0.24	14.02	0.05	0.98	16.90	11.87	0.10	0.16	15.97	19.52	0.09	0.41
IV	1.36	16.49	0.13	0.93	-17.07	14.57	0.09	0.24	-11.32	24.27	0.07	0.64
AR	-0.98	16.50	0.08	0.95	-10.83	14.75	0.02	0.46	-6.29	23.63	0.07	0.79
AUC _{Activity}	0.00	0.00	0.06	0.70	0.00	0.000	0.01	0.77	0.00	0.000	0.07	0.57

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%AUC _{4h}	-0.11	0.62	0.06	0.86	0.45	0.544	0.03	0.41	-0.29	0.876	0.06	0.74
%AUC _{Sleep}	0.29	0.58	0.06	0.61	0.28	0.513	0.01	0.58	0.24	0.820	0.06	0.77
CVAON	-9.88	19.21	0.07	0.61	-6.71	16.782	0.06	0.69	-18.40	26.746	0.11	0.49
CVAOF	-43.84	47.51	0.08	0.36	-22.94	42.439	0.02	0.59	-77.23	67.148	0.09	0.27
CFI	18.37	29.50	0.09	0.54	28.43	26.256	0.03	0.28	57.78	41.468	0.11	0.17
SRI	0.17	0.13	0.09	0.20	0.04	0.119	0.01	0.75	0.25	0.186	0.10	0.18
fSoD	7.81	18.29	0.06	0.67	7.35	16.203	0.02	0.65	12.87	25.901	0.07	0.62
k _{RA}	-62.03	126.10	0.07	0.62	60.93	112.43	0.01	0.59	-28.98	180.08	0.06	0.87

Results considering the NH (n=23) and CM (n=23) groups.

NH = non-headache; CM = chronic migraine; EST = estimate; SE = standard error; STAI = State-Trait Anxiety Inventory; E = state; (+) = positive statements; (-) = negative statements; MESOR = mean estimated statistic over rhythm; Amplitude = difference between the highest value and the MESOR; Acrophase = highest phase point; % V = rhythmic percentage (refers to the degree of fit of the rest-activity rhythm to the cosine curve); L5 = average activity of the 5 continuous least active hours; M10 = average activity of the 10 continuous most active hours; IS = interdaily stability (stability of the rhythm over days); IV = Intradaily variability (a proxy of rhythm fragmentation); RA = Relative amplitude (the difference between M10 and L5 divided by the sum of M10 and L5); AUC_{Activity} = area under the curve of the amount of activity over 24 hours; %AUC_{4h} = amount of activity 4 hours before sleep starts; %AUC_{Sleep} = amount of activity during sleep; CVAON = coefficient of variation of activity onset (variation of wake-up time); CVAOF = coefficient of variation of activity offset (variation of sleep onset time); CFI = Circadian Function Index (a global measure to assess the robustness of the rest-activity rhythm); SRI = Sleep Regularity Index (regularity of sleeping and waking times over days); fSoD = fraction of sleep over daytime; k_{RA} = transition probability to awake once in sustained sleep = the higher the value, the greater the possibility of waking up from sleep.

† The variables represent the values of 34 individuals (NH group = 17; CM group = 17). Multiple linear regression test.

‡ In this analysis, we investigated the interference of the group of individuals with chronic migraine on the interaction between the variables.

Table S5 Linear regression analysis between actimetric variables and trait anxiety symptoms in individuals with and without chronic migraine

Activity/rest rhythm	STAI-T (+)				STAI-T (-)				STAI-T (Total)			
	EST	SE	R ²	p	EST	SE	R ²	p	EST	SE	R ²	p
Interaction between variables												
MESOR [†]	0.08	0.11	0.13	0.51	0.07	0.23	0.03	0.74	0.15	0.31	0.06	0.62
Amplitude [†]	0.07	0.11	0.14	0.55	0.19	0.22	0.06	0.40	0.25	0.30	0.09	0.40
Acrophase	-0.02	0.01	0.13	0.15	-0.02	0.02	0.20	0.31	-0.04	0.03	0.20	0.18
%V	-0.03	0.12	0.04	0.80	0.07	0.23	0.01	0.77	0.04	0.32	0.02	0.91
L5 [†]	0.13	0.21	0.13	0.52	-0.06	0.49	0.01	0.88	0.07	0.55	0.04	0.89
M10 [†]	0.05	0.08	0.18	0.49	0.12	0.16	0.03	0.46	0.17	0.21	0.07	0.43
IS	4.78	7.88	0.06	0.54	13.22	14.95	0.02	0.38	18.01	20.42	0.04	0.38
IV	3.27	9.28	0.10	0.72	-11.95	18.09	0.02	0.51	-8.67	24.66	0.03	0.72
AR	8.40	7.87	0.15	0.29	-0.02	15.67	0.03	0.99	8.39	21.07	0.07	0.69
AUC _{Activity}	0.00	0.00	0.18	0.26	0.00	0.00	0.04	0.67	0.000	0.000	0.08	0.91
%AUC _{4h}	-0.16	0.33	0.15	0.64	-0.39	0.65	0.06	0.55	-0.547	0.875	0.10	0.53
%AUC _{Sleep}	-0.56	0.31	0.35	0.07	-0.54	0.65	0.15	0.41	-1.103	0.840	0.26	0.20
CVAON	-1.19	12.30	0.07	0.92	-3.81	23.65	0.01	0.87	-5.002	32.225	0.02	0.88
CVAOF	9.48	33.41	0.07	0.78	27.10	64.22	0.01	0.67	36.583	87.391	0.03	0.68
CFI	23.15	18.06	0.13	0.21	4.26	35.46	0.03	0.90	27.412	47.888	0.06	0.57
SRI	-0.01	0.09	0.07	0.93	-0.02	0.17	0.05	0.91	-0.028	0.227	0.07	0.90
fSoD	-5.66	10.51	0.06	0.59	-2.49	19.93	0.02	0.90	-8.150	27.216	0.04	0.77
k _{RA}	-28.54	33.80	0.08	0.40	44.49	62.78	0.09	0.48	15.946	86.494	0.08	0.85
CM interference [‡]												
MESOR [†]	-0.08	0.13	0.13	0.55	-0.00	0.25	0.03	0.99	-0.08	0.34	0.06	0.81
Amplitude [†]	-0.11	0.13	0.14	0.39	-0.30	0.25	0.06	0.24	-0.41	0.34	0.09	0.23
Acrophase	0.01	0.01	0.13	0.47	-0.01	0.02	0.20	0.77	0.00	0.03	0.20	0.93
%V	0.04	0.15	0.04	0.77	-0.01	0.28	0.01	0.96	0.03	0.38	0.02	0.94
L5 [†]	-0.19	0.28	0.13	0.51	0.10	0.56	0.01	0.85	-0.09	0.75	0.04	0.91
M10 [†]	-0.13	0.10	0.18	0.19	-0.11	0.20	0.03	0.60	-0.24	0.27	0.07	0.38
IS	-10.18	10.25	0.06	0.32	-17.04	19.44	0.02	0.38	-27.22	26.55	0.04	0.31
IV	10.28	12.27	0.10	0.40	16.30	23.91	0.02	0.49	26.58	32.60	0.03	0.41
RA	-26.57	11.61	0.15	0.02*	-18.50	23.11	0.03	0.42	-45.07	31.07	0.07	0.15
AUC _{Activity}	-0.47	0.43	0.18	0.02*	0.000	0.000	0.04	0.74	0.000	0.000	0.08	0.27
%AUC _{4h}	-0.47	0.43	0.15	0.28	-3.39	0.84	0.06	0.65	-0.856	1.130	0.10	0.45

%AUC _{Sleep}	1.27	0.43	0.35	0.001*	1.48	0.75	0.15	0.15	2.751	0.963	0.26	0.007
CVAON	-6.90	14.11	0.07	0.63	-0.36	27.12	0.01	0.99	-7.260	36.947	0.02	0.84
CVAOF	3.17	34.85	0.07	0.93	-17.64	66.10	0.01	0.79	-14.47	91.168	0.03	0.87
CFI	-41.09	21.13	0.13	0.059*	-26.47	41.50	0.03	0.53	-67.55	56.043	0.06	0.23
SRI	-0.05	0.10	0.07	0.64	-0.09	0.18	0.05	0.63	-0.134	0.251	0.07	0.60
fSoD	12.26	13.42	0.06	0.37	16.73	25.45	0.02	0.51	28.990	34.740	0.04	0.41
k _{RA}	128.95	91.79	0.08	0.17	245.49	170.50	0.09	0.16	374.44	234.90	0.08	0.12

Bold type denotes statistical significance.

Results considering the NH (n=23) and CM (n=23) groups.

NH = non-headache; CM = chronic migraine; EST = estimate; SE = standard error; STAI = State-Trait Anxiety Inventory; T = dash; (+) = positive statements; (-) = negative statements; MESOR = mean estimated statistic over rhythm; Amplitude = difference between the highest value and the MESOR; Acrophase = highest phase point; % V = rhythmic percentage (refers to the degree of fit of the rest-activity rhythm to the cosine curve); L5 = average activity of the 5 continuous least active hours; M10 = average activity of the 10 continuous most active hours; IS = interdaily stability (stability of the rhythm over days); IV = intradaily variability (a proxy of rhythm fragmentation); RA = relative amplitude (the difference between M10 and L5 divided by the sum of M10 and L5); AUC_{Activity} = area under the curve of the amount of activity over 24 hours; %AUC_{4h} = amount of activity 4 hours before sleep starts; %AUC_{Sleep} = amount of activity during sleep; CVAON = coefficient of variation of activity onset (variation of wake-up time); CVAOF = coefficient of variation of activity offset (variation of sleep onset time); CFI = Circadian Function Index (a global measure to assess the robustness of the rest-activity rhythm); SRI = Sleep Regularity Index (regularity of sleeping and waking times over days); fSoD = fraction of sleep over daytime; k_{RA} = transition probability to awake once in sustained sleep = the higher the value, the greater the possibility of waking up from sleep.

† The variables represent the values of 34 individuals (NH group = 17; CM group = 17).

‡ In this analysis, we investigated the interference of the group of individuals with chronic migraine on the interaction between the variables.

Multiple linear regression test, * p < 0.05.

Table S6 Linear regression analysis between actimetric variables and depressive symptoms in individuals with and without chronic migraine

	Estimate	Standard error	R ²	p
Interaction between variables				
MESOR [†]	-0.02	0.16	0.23	0.87
Amplitude [†]	-0.10	0.15	0.27	0.51
Acrophase	0.02	0.02	0.29	0.25
%V	0.01	0.18	0.22	0.93
L5 [†]	0.29	0.28	0.24	0.31
M10 [†]	-0.04	0.11	0.27	0.71
IS	5.13	11.86	0.22	0.66
IV	6.59	13.05	0.35	0.61
AR	-12.57	12.24	0.25	0.31
AUC _{Activity}	0.000	0.000	0.24	0.37
%AUC _{4h}	0.568	0.519	0.24	0.28
%AUC _{Sleep}	-0.036	0.501	0.37	0.94
CVAON	-18.661	17.729	0.29	0.30
CVAOF	-45.826	52.603	0.23	0.37
CFI	-20.625	28.119	0.22	0.47
SRI	-0.023	0.132	0.24	0.86
fSoD	1.305	15.764	0.22	0.93
k _{RA}	-1.350	51.158	0.23	0.98
CM interference [‡]				
MESOR [†]	-0.04	0.18	0.23	0.81
Amplitude [†]	-0.01	0.17	0.27	0.93
Acrophase	-0.03	0.02	0.29	0.08
%V	-0.07	0.22	0.22	0.73
L5 [†]	-0.36	0.38	0.24	0.35
M10 [†]	-0.09	0.14	0.27	0.52
IS	-9.55	15.43	0.22	0.53
IV	26.42	17.25	0.35	0.13
AR	-0.63	18.05	0.25	0.97
AUC _{Activity}	0.000	0.000	0.24	0.81
%AUC _{4h}	-0.852	0.671	0.24	0.21
%AUC _{Sleep}	0.935	0.574	0.37	0.11
CVAON	-0.045	20.327	0.29	1.00
CVAOF	45.644	52.603	0.23	0.39
CFI	15.405	32.908	0.22	0.64
SRI	-0.051	0.146	0.24	0.73
fSoD	8.469	20.122	0.22	0.68
k _{RA}	128.455	138.932	0.23	0.36

Results considering the NH (n=23) and CM (n=23) groups.

IDB = Beck's Depression Inventory; MESOR = mean estimated statistic over rhythm; Amplitude = difference between the highest value and the MESOR; Acrophase = highest phase point; % V = rhythmic percentage (refers to the degree of fit of the rest-activity rhythm to the cosine curve); L5 = average activity of the 5 continuous least active hours; M10 = average activity of the 10 continuous most active hours; IS = interdaily stability (stability of the rhythm over days); IV = intradaily variability (a proxy of rhythm fragmentation); RA = relative amplitude (the difference between M10 and L5 divided by the sum of M10 and L5); AUC_{Activity} = area under the curve of the amount of activity over 24 hours; %AUC_{4h} = amount of activity 4 hours before sleep starts; %AUC_{Sleep} = amount of activity during sleep; CVAON = coefficient of variation of activity onset (variation of wake-up time); CVAOF = coefficient of variation of activity offset (variation of sleep onset time); CFI = Circadian Function Index (a global measure to assess the robustness of the rest-activity rhythm); SRI = Sleep Regularity Index (regularity of sleeping and waking times over days); fSoD = fraction of sleep over daytime; k_{RA} = transition probability to awake once in sustained sleep = the higher the value, the greater the possibility of waking up from sleep.

[†] The variables represent the values of 34 individuals (NH group = 17; CM group = 17). Multiple linear regression test.

[‡] In this analysis, we investigated the interference of the group of individuals with CM on the interaction between variables.