

## **ABOUT HALF-WEEKLY (CIRCASEMISEPTAN) PATTERN OF BLOOD PRESSURE AND HEART RATE IN MEN AND WOMEN OF INDIA**

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### **A b s t r a c t**

For a reliable diagnosis of hypertension, around-the-clock monitoring for 7 days or longer has been advocated. As part of a larger study in India, 32 subjects had their blood pressure and heart rate measured manually every 3 h for 7 days. As expected, spectral peaks corresponded to circadian variation. The about half-weekly component was statistically significant. Separate analyses of the data collected during consecutive days indicated that large day-to-day changes may, in part, have been accounted for by adaptation to the measurements. The results corroborate the view that, if reliable values are to be obtained, serial measurements for at least 7 days are needed

### **Key words**

Circasemiseptan rhythm, Blood pressure, Heart rate

### **INTRODUCTION**

Blood pressure (BP) and heart rate (HR) values are usually higher at daytime and lower at night in diurnally active and nocturnally resting subjects (1). Ambulatory monitoring of BP and HR carried out for 24 hours on several occasions reveals large day-to-day changes in circadian characteristics (2). Longitudinal records further show how emotions and other life events may transiently affect circadian variation in BP and HR (1, 3, 4). Whereas the uncertainty associated with the estimation of circadian characteristics of BP and HR are already drastically reduced (by ~35%) by collecting data over a 48- rather than a 24-hour span (5), it has been recommended to monitor these variables for 7 days or longer (6). This study describes circadian characteristics of BP and HR measured manually in a selected population of India.

### **MATERIALS AND METHODS**

As part of a larger study, data from 32 individuals were analysed. This group comprised 24 men and 8 women aged 23 to 72 years. Systolic (S) and diastolic (D) blood pressure (BP, Korotkoff) were measured every 3 h for 7 days in each subject. Each data series was analysed by the least-square

spectrum (7, 8) in the frequency range of 1 to 20 cycles per week. For each period of the trial, the results from all subjects were summarised by the population-mean cosinor (7, 8).

## RESULTS

Individually, a circadian rhythm was demonstrated for SBP in 16 subjects, for DBP in 15 subjects and for HR in nine subjects with statistical significance ( $P < 0.05$ ). The 24-hour component of SBP, DBP and HR was found to have a borderline statistical significance in further four, five and four subjects, respectively. The double circadian amplitude, a measure of the predictable extent of change within a day, varied from 1 to 29 mm Hg and from 1 to 24 mm Hg in SBP and DBP, respectively, and from 1 to 16 beats per min in HR. On the average, the double circadian amplitudes were (mean  $\pm$  SD)  $8.7 \pm 7.2$  mm Hg (SBP),  $9.1 \pm 5.2$  mm Hg (DBP), and  $5.1 \pm 3.6$  beats/min (HR).

On the group basis, the circadian component corresponded to a spectral peak in both SBP and DBP, even though it was not statistically significant. The prominence of the circadian component and harmonic terms (with periods of 12 and 8 h) was seen in both phase-weighted (by population-mean cosinor) and phase-unweighted spectra.

A half-weekly component was statistically significant ( $P < 0.01$ ) for SBP and DBP (Table 1). BP values were higher in the early morning on Mondays and in the afternoon on Thursdays.

In order to examine the extent of day-to-day variability in the circadian characteristics of BP and HR, a 24-hour cosine curve was fitted by cosinor to the data collected during each day. The MESOR and circadian amplitude were then averaged across all subjects for each of the 7 days of monitoring. A one-way analysis of variance was used to test the equality of each circadian characteristic on every day of the week. The MESOR of BP and HR increased, reflecting the load of normal measurements on the subjects. A steady increase was statistically significant for SBP ( $P < 0.005$ ), DBP ( $P < 0.001$ ) and HR ( $P < 0.001$ ). Whereas most of the increase in DBP and HR occurred from day 1 to day 3, in SBP, a plateau was not reached even after 7 days of monitoring. The increase in MESOR was accompanied by a decrease in the amplitude of circadian variation; this was statistically significant for DBP ( $P < 0.001$ ) but not for SBP ( $P = 0.667$ ) or HR ( $P = 0.108$ ).

## DISCUSSION

Our results of the circasemiseptan rhythm in blood pressure were similar to the findings made in the Czech Republic, where 50 patients were screened by ambulatory monitoring for 7 days (9). In that study, the circasemiseptan component was also statistically significant for BP, which tended to assume higher values on midweek days than during weekends. The large increasing trend in both BP and HR observed in our study may have contributed to the observed infradian

Table 1

Least-square spectra of blood pressure and heart rate

Period (hours)	SBP		DBP		HR	
	Double amplitude	P	Double amplitude	P	Double amplitude	P
168.0	0.95	NS	1.11	NS	0.51	NS
84.0	1.69	0.010	2.56	<0.001	0.42	NS
56.0	0.99	0.078	0.84	NS	0.64	0.082
42.0	0.18	NS	0.75	NS	0.05	NS
33.6	0.75	NS	0.88	NS	0.41	NS
28.0	1.18	NS	0.83	NS	0.85	NS
24.0	1.87	NS	2.16	NS	0.94	NS
21.0	0.08	NS	0.96	NS	0.10	NS
18.7	0.19	NS	0.64	NS	0.26	NS
16.8	0.83	NS	0.21	NS	0.30	NS
15.3	0.20	NS	0.34	NS	0.23	NS
14.0	1.09	NS	0.41	NS	0.65	NS
12.9	0.61	NS	0.69	NS	0.23	NS
12.0	2.42	NS	1.68	NS	0.83	NS
11.2	0.36	NS	1.60	NS	0.09	NS
10.5	0.22	NS	0.23	NS	0.63	NS
9.9	0.59	NS	0.23	NS	0.18	NS
9.3	0.58	NS	0.39	NS	0.23	NS
8.8	0.38	NS	0.45	NS	0.63	NS
8.4	0.40	NS	0.97	NS	0.54	NS
8.0	1.40	NS	0.80	NS	0.95	NS

P, *P* - value of significance; NS, not significant; SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate.

components. It is noteworthy, however, that only the circasemiseptan and not the circaseptan component was demonstrated with statistical significance, suggesting that the increasing trend in BP and HR may not be solely responsible for the half-weekly pattern.

The half-weekly pattern of SBP and DBP in this study resembles that of morbidity/mortality patterns from cardiovascular causes such as myocardial infarctions and strokes. Even though, on a group basis, the circadian component was not statistically significant, this component and its harmonics were characterised by relatively large amplitudes. The lack of statistical significance stems primarily from the large discordance in acrophase among the subjects. The odd phasing of the circadian BP rhythm in many of the subjects investigated may have been due to the fact that measurements were made manually when the

subjects were awake. BP is usually lower during sleep and/or rest, as illustrated by automatic monitoring of blood pressure.

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### CIRKA-SEMISEPTÁNNÍ RYTMY V KREVNÍM TLAKU A SRDEČNÍ FREKVENCI U INDICKÝCH MUŽŮ A ŽEN

#### S o u h r n

Pro diagnostiku hypertenze je doporučeno monitorovat krevní tlak 24 hodin denně po dobu 7 dnů. Jako součást velké studie v Indii, 32 osob si měřilo krevní tlak a srdeční frekvenci manuálně v tříhodinových intervalech po dobu sedmi dní. Dle předpokladu, spektrální vrcholy odpovídaly cirkadiánnímu rytmu. Dále byla nalezena statisticky významná komponenta přibližně odpovídající polovině týdne. Analýza dat získaná v následujících dnech ukázala velké změny mezi denními výsledky, které mohly být způsobeny návykem na měření krevního tlaku. Výsledky potvrdily nezbytnost měření krevního tlaku po dobu nejméně 7 dnů.

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