A 36-HOUR COMPARISON OF CORE TEMPERATURE AT REST AND DURING EXERCISE USING RECTAL PROBE AND PILL TELEMETRY

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Long-term measurement of core temperature in unrestrained humans is being made possible by recent development of pill telemetry technology. The technology, however, has been previously validated only over a short time period ranging from 1 to 3 hours. Since the mobility of the pill in the GI tract has been identified to change the absolute temperature of the pill and its temperature response characteristics, it is essential to validate the technology for a longer time period if the pill telemetry is to be used for several hours. Eleven non heat-acclimatized males volunteered to participate in two 36-hour sleep deprivation studies where their core temperature was continuously monitored using a rectal probe inserted 15 cm beyond the anal sphincter, and a pill telemetry ingested at the beginning of each study. The data were collected about 40 min after the ingestion of the pill using small data loggers attached to the subjects. The subjects, dressed with shorts and T-shirt, rested in an environmental chamber maintained at 30°C and 50% relative humidity for the duration of the studies. On 3 occasions during each study and separated by a 12-hour interval, the subjects exercised on a treadmill for 2 hours to elevate their core temperature to about 39°C. The subjects walked at 5.6 km/h with a 7-14% grade or ran at 8.8 km/h on the level. The temperature of all ingested fluid was controlled at 37°C to minimize any drink-induced effects on core temperature, particularly on the temperature readings from the pill telemetry. During the resting periods over the 36-hour studies, there was no statistical difference ($p = 0.065$) between the rectal probe (37.45 ± 0.20°C) and the pill telemetry (37.4 ± 0.24°C) readings, the absolute difference averaging 0.12 ± 0.09 °C. This absolute temperature difference was similar between the first hour of data collection (0.15 ± 0.11°C) and the 36th hour of data collection (0.15 ± 0.14°C). These results do not support an effect of the mobility of the pill in the GI tract on the temperature difference with the rectal temperature readings. By the end of the exercise sessions, the subjects were hyperthermic with a core temperature averaging 38.96 ± 0.40°C. On average during the exercise sessions, there was a statistical difference ($p < 0.05$) between the rectal probe (38.51 ± 0.24°C) and the pill telemetry (38.39 ± 0.25°C) readings, the absolute difference averaging 0.24 ± 0.10°C. This absolute difference was significantly larger than the one observed during the rest periods ($p < 0.05$). It was concluded that during rest periods, the pill telemetry is able to estimate core temperature as well as a rectal probe for the whole transit time of the pill in the GI tract ($> \sim24$ hours). During exercise, however, a low GI perfusion could be responsible for a temperature lag.

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