THE ROLE OF MELATONIN IN HUMAN THERMOREGULATION AND SLEEP

by

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Abstract

A putative role for the pineal hormone melatonin in the regulation of normal sleep has often been suggested. This is based primarily on the coincidence of nocturnal melatonin production with normal sleep and that daytime administration is associated with soporific effects. A significant suppression of daytime core body temperature after melatonin administration has also led to suggestions that thermoregulatory effects may mediate the soporific effects of melatonin.

However, the majority of previous studies have utilised melatonin administration protocols that produce high peak hormone levels or short durations in the circulation. Therefore, the aim of studies in this thesis was to determine the effects of melatonin on sleepiness and body temperatures under conditions that better approximated the endogenous melatonin profile. First, an examination of the effects of endogenous melatonin onset was undertaken both in the presence and absence of normal sleep. Next, two melatonin administration studies attempted to reproduce endogenous levels of melatonin during the day with long or short durations. Finally, the potential for beneficial soporific effects of a nocturnal melatonin pulse was assessed in elderly chronic insomniacs.

The results of the first study suggest that there are few, if any effects on sleepiness and thermoregulation at endogenous melatonin onset. The daytime melatonin administration studies provide evidence that both peak level and rate of onset of melatonin interact to determine the acute affects of melatonin administration. This knowledge could lead to a more effective use of melatonin as a therapy for sleep disturbance. In elderly insomniacs, sustained supraphysiological melatonin administration was able to significantly lower rectal
core and hand skin temperatures. However, this change in thermoregulatory output was achieved without any concurrent changes in sleep quality or architecture. Therefore, an age-related increase in nocturnal body temperature is unlikely to be related to concurrent increases in sleep disturbance, they may rather arise directly from decreased responsiveness to endogenous melatonin production. It is also clear that there is no simple relationship between melatonin and its acute effects on temperature and sleepiness, which are influenced by factors including time of administration, age, dose and rate of onset in the circulation.