

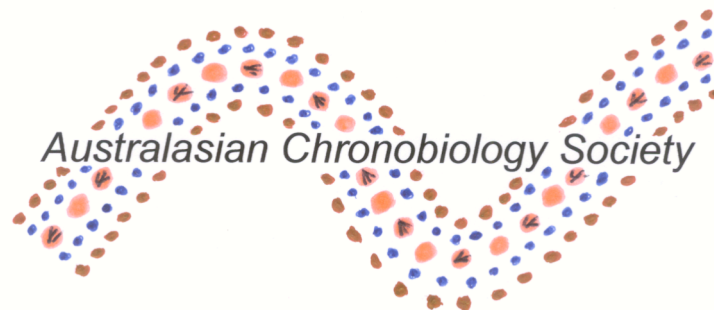
Living in a 24/7 World:

The impact of circadian disruption on sleep, work and health

Australasian Chronobiology Society
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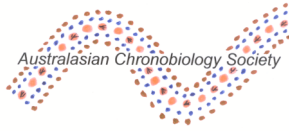
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Chapter 5

Does chronotype affect elite athletes' capacity to cope with the training demands of triathlon?

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Aims: The aims of the present study were to identify the chronotype of Australia's elite triathletes and to determine whether morning-types (M-types) compared to neither-types (N-types) and evening-types (E-types) are better able to cope with the demands of early morning training.

Methods: Twenty-three elite triathletes (7 female and 16 male) from the Australian Institute of Sport were surveyed at the start of a training camp. Participants completed the Morningness-Eveningness Questionnaire (MEQ), Epworth Sleepiness Scale, and two questions concerning sleep satisfaction and sleep quality. Participants were assigned to a chronotype group on the basis of MEQ scores using the Horne and Ostberg classification system. Independent samples t-tests were used to compare subjective sleep variables (i.e. daytime sleepiness, sleep satisfaction, sleep quality) between chronotype groups.

Results: Twelve participants were N-types, 11 were M-types and nil participants were E-types. There was no difference in daytime sleepiness, sleep satisfaction, sleep quality between M-types and N-types. There was no difference in the gender distribution between chronotype groups.

Discussion: The results from the present study revealed that triathletes at the elite level tend to show either a morning or neither preference. There were no E-types within this sample of elite triathletes. This finding supports the notion that E-types do not select sports which require early morning training. Further, no differences were found for daytime sleepiness, sleep satisfaction, and sleep quality between M-types and N-types.

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Introduction

Triathlon is a multisport endurance event which consists of sequential swimming, cycling, and running events. The combination and varying distances of these events makes triathlon extremely challenging. Elite triathletes undertake multiple training sessions each day and typically commence the first session relatively early in the morning. This type of early morning schedule has its advantages (1) it enables triathletes ample time to work on technique to become proficient in all three sports (i.e. swimming, cycling, running), (2) early start times model competition start times,

which has been shown to enhance performance, and (3) it provides triathletes with the opportunity to recover between sessions.

One disadvantage is that an athletes' chronotype may affect their ability to cope with repeated early morning start times. Chronotype is a genetically determined predisposition that modifies each individual's preference to be most active in the morning (M-type), middle of the day (N-type, neither morning nor evening) or in the evening (E-type).¹ For example, E-types prefer sleeping at later hours and find it difficult to get up in the

morning. On the contrary, M-types prefer going to bed and waking up early.^{2,6} The aims of the present study were to identify the chronotype of Australian elite triathletes and to determine whether M-types are better able to cope with the demands of early morning training compared to N-types and E-types.

Methods

Participants

Twenty-three elite triathletes (7 female and 16 male) from the Australian Institute of Sport volunteered to participate in this study. At the time of the study all athletes had a minimum of one year experience at national level. Participants' characteristics are presented in Table 1. The study was approved by the University of South Australia Human Research Ethics Committee and all participants provided written informed consent.

Table 1. Participants' characteristics.

Parameters	Male	Female
Age (yr)	20.9 ± 2.1	20.8 ± 3.6
Height (cm)	178.6 ± 5.8	163.8 ± 4.5
Body mass (kg)	68.2 ± 1.2	52.5 ± 1.2
VO _{2 peak} (ml/kg/min)	72.6 ± 3.6	63.3 ± 4.3

Note 1: VO_{2 peak} is peak oxygen consumption.

Note 2: Data are presented as mean ± SD.

Measures

Morningness-Eveningness Questionnaire. Chronotype was evaluated using the Horne and Ostberg Morningness-Eveningness Questionnaire (MEQ).³ The MEQ is a self-assessment questionnaire which categorizes individuals based on their preference toward morning or evening. The questionnaire consists of 19 questions asking about behaviour preferences (e.g. *If you had no commitments the next day and were entirely free to plan your own day, what time would you get up?*). Scores are then used to determine chronotype. The questions yield scores ranging from 16 to 96. Based on their MEQ scores participants were assigned to a

chronotype group, morning-types (M-types, 59-86), neither-types (N-types, 42-58), or evening-types (E-types, 16-41).

Epworth Sleepiness Scale. The Epworth Sleepiness Scale was used to assess subjective daytime sleepiness. Participants rate their probability of falling asleep in eight different situations (e.g. *sitting and reading*) using a scale that ranges from 'would never doze' to 'high chance of dozing'. Scores are summed to obtain a total. Higher scores indicate a greater level of subjective daytime sleepiness.

Subjective Sleep Satisfaction and Subjective Sleep Quality. Participants were asked to rate their overall sleep satisfaction using a 10-point scale, where one equals 'very dissatisfied' and ten equals 'very satisfied'. Participants were asked to rate their overall sleep quality using a 6-point scale, where one equals 'very poor' and six equals 'excellent'.

Data Collection

Participants completed the MEQ, Epworth Sleepiness Scale, and questions concerning their sleep satisfaction and sleep quality at the start of a triathlon training camp. The training camp consisted of multiple training sessions (e.g. swimming, cycling, and running) each day for a period of three weeks. Each day, athletes typically commenced their first training session at ~0700h.

Data Analysis

Participants' were assigned to one of two groups for comparative analyses on the basis of MEQ scores. Independent samples t-tests were conducted to determine if there were any differences between the groups for measures of subjective daytime sleepiness, sleep satisfaction, and sleep quality. A chi-square test was conducted to determine if the distribution of gender varied between chronotype groups.

Table 2. Subjective sleep variables as a function of chronotype.

Subjective Sleep Variable	Chronotype		t-test		
	Morning (n=11)	Neither (n=12)	t	df	p
Epworth Sleepiness Scale	7.3 ± 3.3	8.9 ± 2.8	-1.23	21	.23
Satisfaction with Sleep	7.2 ± 1.1	6.8 ± 1.5	0.63	21	.54
Sleep Quality	4.5 ± 0.7	4.2 ± 0.7	1.29	21	.21

Results

The mean chronotype score for the sample was 58 with a range from 45 to 71. Using the classification system of Horne and Ostberg,³ 12 participants were N-types and 11 participants were M-types. No participants were E-types. There were no differences between the M-types and N-types for subjective daytime sleepiness, sleep satisfaction, or sleep quality (Table 2). There was no difference in the distribution of gender between the two chronotypes ($X^2(2) = .35, p = .06$).

Discussion

An interesting finding in the present study was that no E-types were identified within this sample. There are two plausible explanations for this (1) it could be that E-types do not select sports which require repeated early morning training and (2) triathletes' behaviour may adapt to the early morning training schedules. An additional explanation could be that triathletes who display a preference toward sleeping later and getting up later (e.g. E-types) may not have progressed from sub-elite levels. These data are consistent with previous investigations indicating that morning practiced sports tend to attract M-types.⁷ However, this has only been found within elite athletic populations. The fact that the same has not been found within sub-elite athletic populations⁵ suggests that individuals who select sports which coincide with their preferred chronotype may be better able to cope with the demands of the sport and advance to elite levels.

There were no differences in subjective daytime sleepiness, sleep satisfaction, or sleep quality between M-types and N-types. There are a number of plausible explanations for this. The mean

morningness/eveningness score for N-types (i.e. 53.3 ± 3.4) suggests that the N-type group displayed tendencies toward a morning preference. Therefore, the means for subjective daytime sleepiness, sleep satisfaction and sleep quality were similar across groups (i.e. M-type and N-types). These data indicate that an individual's preference toward the morning or evening may be the difference between a sub-elite and elite level triathlete. Further, it seems plausible to suggest that within this group of elite triathletes, those who show no specific tendency toward morning or evening (i.e. N-types) may have adapted their circadian preference toward morning through the years of participation.¹

There are some limitations of the present study. One observation must be directed toward the subjective nature and accuracy of the questionnaires administered. With respect to the MEQ it may be difficult to differentiate between the accustomed behaviour of triathletes and actual choice of behaviour. To be explicit, the MEQ is a preference based questionnaire which asks questions regarding behaviour which may not be reflective of an individual's chronotype. This issue could be addressed by directly assessing chronotype via a constant routine protocol using objective measures such as plasma melatonin and core body temperature.⁴ While objective data are desirable, self-report questionnaires were the most practicable means of obtaining data within this population of elite athletes. Future studies should examine other morning based sports (e.g. swimming, rowing) to determine if the patterns are similar. These investigations may lead us toward using chronotype as a talent identification tool.

Acknowledgements

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