# TRAINING EFFECT DURING THE MIDNIGHT SUN PERIOD IN DIFFERENT CHRONOTYPES.

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**Introduction:** Our research takes place at 70ºN. Where the sun is above the horizon for 8 weeks during summer, midnight sun and below the horizon for 8 weeks during winter, polar night. Earlier we found that adults with different chronotypes responded differently to exercise performed in day-light or darkness[1]. During the polar night evening (E) and neither (N) -types respond to training better than morning (M) –types[2]. This study reports the effect of training during the midnight sun period in individuals with different chronotypes.

## Method

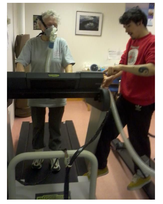
Internett:
262 persons chonotype[3]
(MEQ: 16-41 E; 42-58 N; 59-86 M)

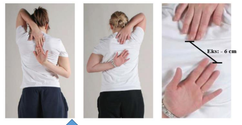
Excluded:
trained organized,
health problems:

Invited:
14 E MEQ: 17-30, 7 F + 7 M
8 N MEQ: 48-57, 4 F + 4 M
10 M MEQ: 69-77, 4 F + 2 M

**Tested: Start May**

Showed up for test:
2 E MEQ: 29, 1 F + 1 M
5 N MEQ: 48-56, 5 F
6 M MEQ: 69-77, 4 F + 2 M





2 E MEQ: 29 , 1 F +1 M
3 N MEQ: 48-51, 3 F
6 M MEQ: 69-77, 4F + 2 M

**Tested: Start August**

Training for 10 weeks,
Log and Heart rate
monitoring.

**Group trainings**: Outside: walking hills, pyramid interval, short interval. Inside circle training. **Homework**: brushing teeth one leg, short towel for back, lay down-turn over – stand up and strength exercises. **Vacation program.**

**Results:** All participants except one E-type, showed a **decrease in $VO_2$max** from May to August. This participant increased the $VO_2$max to 51ml/min x kg from 38 ml/min x kg. We suspect that the result in May is too low, or that the result in August is wrong. If we exclude this person from the study, we have only 1 E-type, 3 N-types and 6 M-types. It seems as if it is **difficult to get and keep** the E-types as **participants** in the study. The training logs showed that the participants had been active, but not in the organized training activity. The heart rate recordings were insufficient.

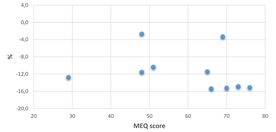



**Fig 1**: Changes in $VO_2$max from May August in % of the May value ((August-May)/May)*100 in different chronotypes (MEQ), not shown the sunbject with

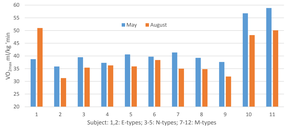



**Fig 2**: $VO_{2max}$ in May and August in subject with different chronotypes

**Conclusion:** Participating in organized training seems to be hard during the midnight sun period. Continuous follow-up and motivation is necessary to keep subjects in a study were training is required. Especially E-types seem to need special follow-up. Even if the participants claimed they were active during the 10-week training period, we could not observe any positive training effect. It seems that the participants have more choices for activity like hikes, fishing and other out-of-doors activity. These activities might not have the intensity required to increase physical fitness, no matter what chronotype the subject belongs to. During the midnight sun period, the biggest **challenge is to get people to choose activities that give high enough intensity to get a training benefit**. The group size is a limiting factor.

References:
1: Rossi, A .et al (2013). The chronotype can influence the perceived exertion during self-paced exercise performed at different times of day. Sport sciences for health, 9(Suppl. 1), 55-56.
2: Vitale, J. et al: Chronotype and response to training during the polar night: a pilot study. International Journal of Circumpolar Health. In press. 2017.
3:Horne JA, Ostberg O. A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. *Int J Chronobiol* 1976;4:97–111.

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