FFI Forsvarets forskningsinstitutt
Norwegian Defence Research Establishment

Multiple Stress During Soldier Training Affect the Core and Skin Temperature

Hilde Kristin Teien and Per Kristian Opstad E-mail: Hilde-Kristin.Teien@ffi.no, Per-Kristian.Opstad@ffi.no

INTRODUCTION

Accidental hypothermia is a condition that everybody may experience and that occur in all seasons and locations. Hypothermia has been a problem in military conflicts and exercises [1]. Reduced core temperature combined with increased skin temperature has been observed among cadets at the Norwegian Military Academy after exposed to multiple stressors [2]. Whether this is due to lowered hypothalamic set-point for core temperature or fatigue of thermoregulatory responses is not established.

The aim of this study was to investigate the effect of continuous military operations on soldier's core temperature and alterations in the set-point, and to evaluate the effect of additional nutrition (6000 kcal/on day 6) [3].

SUBJECT AND METHODS

18 cadets from the Norwegian Military Academy who participated in a 7 days ranger training course were included; some were withdrawn because of medical causalities. 6 cadets in the experiment group (EG) (BMI: 24.6 ± 1.5 kg/m²) who got 6000 kcal on day 6 were compared with the control group (CG) of 4 cadets (BMI: 24.0 ± 0.7 kg/m²) who got the standard diet containing 750 kcal/day. Heart rate, core and skin temperature were recorded as well as changes in trijodothyronine (T3), tyroxin (T4) and thyroid-stimulating hormone (TSH) concentrations in serum. Body composition was investigated before and immediately after the course (Inbody 720). Statistical analysis was performed with repeated-measure MANOVA ($p < 0.05$) and paired and related samples t-tests in SPSS (IBM SPSS Statistics 19).

RESULTS

Stress during soldiers training resulted in reduction in rectal temperature ($p = 0.029$) combined with increased skin temperature. A clear relationship between stress and increased feet temperature in the EG 6.2 ± 2.1 °C ($p = 1 \times 10^{-5}$) and CG 4.2 ± 1.2 °C ($p = 0.005$) was observed. Additional nutrition provided a significant increased effect in core temperature (0.4 °C) compared with the CG. Stress resulted in a reduction in T3 in both groups compared to situation with no stress. Additional nutrition during day 6 showed a lower reduction in T3 ($p = 0.008$), but no significant difference for T4 and TSH was observed when compared to the CG. A significant reduction in the bodyweight and fat mass was noted for both groups; $p = 9 \times 10^{-8}$ and $p = 2 \times 10^{-6}$, respectively, where weight loss was mainly due to reduction in fat mass. Additional nutrition provided reduced body weight loss ($p = 0.041$) compared with CG. EG and CG had an average weight loss of 4.5 kg (6.7-4.2 kg) and 5.4 kg (6.0-3.0 kg), respectively.

CONCLUSION

Multiple stressors affect both the core and the skin temperature with a reduced core temperature combined with an increase in skin temperature.

This may be due to reduced set-point. However, this observation may be due to an increase in vasodilation in response to changes in the concentration of signal molecules and receptors on the target cells. Nutrition may contribute to the difference in core temperature between the two groups, but the impact of physical activity can not be excluded. Alterations in the thyroid function may also have led to the reduced core temperature. The loss of fat mass may contribute to increased heat loss due to reduced isolation of the body to the colder environment.

This study suggest that the cadets are more vulnerable to become hypothermic but more protected against frostbites or cold injuries.

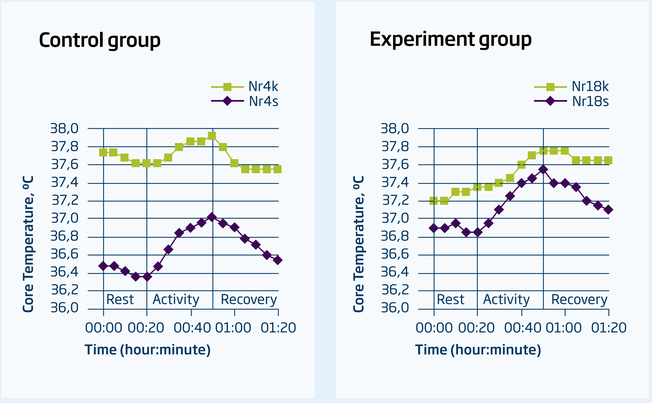

Figure 1: Changes in core temperature in the control and experiment group in control and stress experiment, represented by cadet number 4 and 18, respectively.

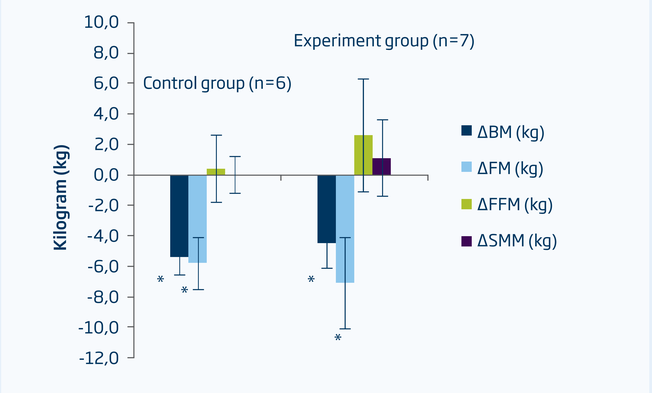

Figure 2: Changes in body composition after 7 days with multiple stressors in the control and experiment group.
**P < 0,05 vs baseline.*

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