

Contribution of individual components of the Slovene Armed Forces desert ensemble to overall heat strain

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Purpose: The participation of Slovene Armed Forces (SAF) personnel in peace-keeping missions in various regions of the world has necessitated the introduction of garment ensembles capable of protecting personnel exposed to the ambient conditions of these regions. The aim of the study was to assess the contribution of each component of the SAF desert ensemble to overall heat strain in simulated desert conditions. This would provide information regarding the adequacy of individual components, as well as the complete garment ensemble. **Methods:** Nine healthy male subjects participated in the study. Their average (SD) age, height, mass and percent body fat was 21.7 (2.5) yrs, 177.6 (5.3) cm, 70.5 (6.9) kg, and 12.0 (3.7)%, respectively. Each subject completed 5 trials (T1 to T5) comprising a one hour step test in simulated desert conditions : ambient temperature at 46.1 (0.2)°C and relative humidity at 20.3 (1.5)%. During the trials, subjects wore different combinations of the desert ensemble, so that the resultant strain could be determined of wearing the garment ensemble with (T5) or without (T1) the NBC (nuclear, biological, chemical) outer layer. In Trials 3 and 4, the tests were carried out without helmet (T3) or without bullet proof vest (T4), , and in Trial 2 without both helmet and vest. During each trial, the subjects wore a knapsack, the weight of which was adjusted to ensure that the same absolute work rate was conducted in all trials. We monitored rectal (Tre) and skin (Tsk: average of arm, chest, thigh calf sites) temperatures, heart rate (HR) and subjective ratings of thermal comfort. Trials were terminated at the request of the subject, or in the event that Tre attained 39°C. The thermal and evaporative resistances were also determined with a thermal manikin. **Results:** The average duration of T5 was significantly shorter than the other trials. There were no significant differences between the responses observed in trials 1 to 4. Despite the shorter duration of T5, the observed responses (Tre, Tsk, HR, thermal comfort) were significantly higher than in trials 1 to 4. The duration of the trials was inversely proportional to the evaporative resistances of the garment combinations determined with a thermal manikin.

Trials	T1	T2	T3	T4	T5
Ensemble	Complete	- helmet & vest	- helmet	- vest	+ NBC
Knapsack, kg	20	28.7	21.7	27	20
Duration, min	47.7(11.5)	49.0 (7.1)	51.7 (9.7)	48.7 (8.6)	34.8 (6.8)
Completed trials, N	3	1	4	2	0
Tsk, °C	38.2 (0.1)	38.2 (0.5)	38.5 (0.1)	38.4 (0.3)	39.1 (0.1)
Tre, °C	38.9 (0.1)	39.0 (0.1)	38.9 (0.1)	38.8 (0.1)	39.0 (0.1)
HR, beatsmin ⁻¹	151 (24)	151 (14)	148 (18)	148 (22)	165 (22)

Conclusions: With the exception of the NBC layer (T5), there was no significant added contribution of either the helmet (T3), bullet proof vest (T4), or a combination of both (T2) to the overall observed thermal strain under the conditions of the tests. Of main concern in future development of desert garment ensembles is the NBC outer layer.