

The Physiological and Performance Consequences of the Australian Special Forces Selection Course

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Background & Purpose

Special Forces training courses are often associated with multifactor stressors, including intense physical activity, heavy load carriage, cognitive and psychological stress, inadequate nutritional intake, and deliberate sleep deprivation. These combined stressors are known to cause negative changes in physiology and physical performance, such as significant decreases in muscle mass, hormonal disruption, and decreases in strength and power. The magnitude of such changes, and the time course required for recovery, are critical to understand due to the implications for injury risk and operational readiness.

The purpose of this study was to investigate the Australian Special Forces Selection Course (SF-SC), including an assessment of energy expenditure and deficit, the physiological and performance responses to the course and throughout the recovery period, in order to inform strategies to optimise recovery and performance following the SF-SC.

Methods

- Observational cohort study monitoring changes in response to the SF-SC and throughout 8 week recovery period
- Ethics approval granted by ECU and DDVA HREC
- 93 candidates from the 2021 SF-SC consented to participate

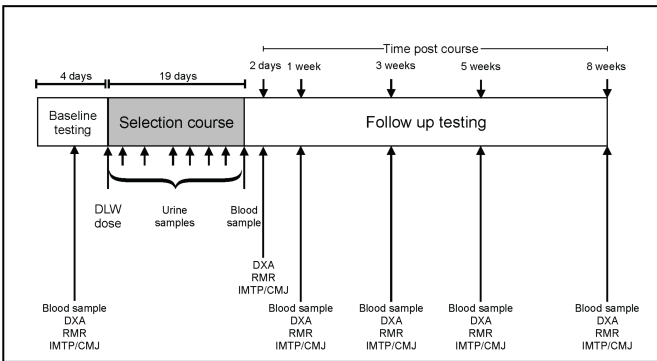
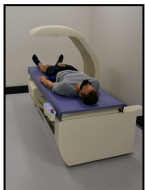
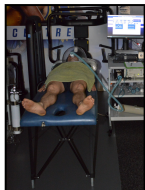


Figure 1. Research project testing timeline

- **Energy expenditure:** Doubly labelled water (DLW)
- **Energy intake:** counting & weighing fresh food & rations
- **Body composition:** via Dual X-ray Absorptiometry (DXA)
- **Resting metabolic rate (RMR):** via Indirect Calorimetry
- **Serum hormones:** Testosterone, Cortisol, SHBG, IGF-1, T3, T4, TSH
- **Strength:** Isometric Mid-Thigh Pull (IMTP)
- **Power:** Counter-Movement Jump (CMJ)



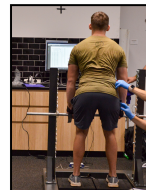
Body Comp (DXA)



RMR (indirect calorimetry)



Counter Movement Jump



Isometric Mid-Thigh Pull

Results

Abbreviated results for pre-post course changes. Comprehensive results will be available in publication via QR code below.

- **Energy:** Expenditure (first 10 days): 7680 ± 1095 kcal/d, intake: 3859 ± 704 kcal/d (Table 1). Carbohydrate intake well below requirements (8-10g/kg/day) in all phases
- **Body comp:** fat mass: $\downarrow 36.1 \pm 6.1\%$, $p < 0.0001$ lean mass: $\downarrow 4.3 \pm 2.4\%$, $p < 0.0001$
- **Hormones:** Significant ($p < 0.001$) disruption to all hormones except TSH e.g. Free testosterone: $\downarrow 92.6 \pm 4.6\%$ (Figure 2A), Cortisol: $\uparrow 293 \pm 142\%$, IGF-1: $\downarrow 71.4 \pm 5.5\%$
- **RMR:** $\downarrow 8.0 \pm 7.1\%$ ($p < 0.01$), rebounded above baseline levels ($\uparrow 13.4 \pm 9.7\%$, $p < 0.01$) one week post-course
- **Performance:** IMTP: Peak force $\downarrow 16 \pm 11\%$ ($p < 0.01$), CMJ: peak power $\downarrow 30 \pm 5.6\%$ ($p < 0.001$) (Figure 2B)
- Recovery of all variables except IGF-1: 1-3 weeks post-course

Table 1. Average daily dietary intake per person by phase of SF-SC

	Total energy intake	Protein		Carbohydrate			Fat			
	kcal.day ⁻¹	g.day ⁻¹	%	g.kg ⁻¹ d ⁻¹	g.day ⁻¹	%	g.kg ⁻¹ d ⁻¹	g.day ⁻¹	%	g.kg ⁻¹ d ⁻¹
Phase 1	3859 ± 704	163 ± 40	18	1.9	463 ± 152	47	5.4	142 ± 37	35	1.7
Phase 2	4139 ± 322	136 ± 8.3	13	1.6	611 ± 12.6	55	7.2	148 ± 106	32	1.7
Phase 3	446 ± 647	23 ± 33	21	0.3	58 ± 91	50	0.7	14 ± 20	29	0.2

Note: Data is presented as mean ± SD. % represents proportion of total energy provided by macronutrient. g.kg⁻¹d⁻¹. % values based on the average participant body weight of 85.1 kg.

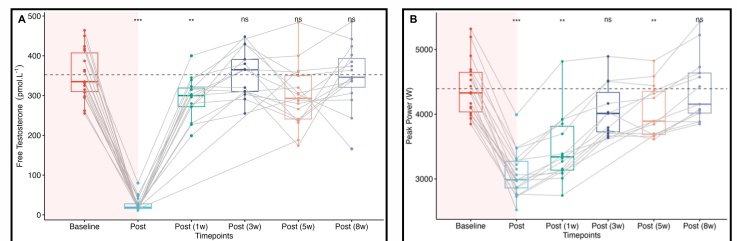


Figure 2. Box and whisker plots of changes in A: Free Testosterone (pmol/L) and B: CMJ peak power (Watts). Statistical differences represent differences compared to baseline from Wilcoxon rank test at level of significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, **** $p < 0.0001$. Red shading represents the baseline to immediately post course period.

Research Impact & Translation

This study demonstrated that the combined stressors of the SF-SC resulted in significant detriments to body composition and physical performance, and a catabolic hormonal response, with most variables taking 1-3 weeks to recover to baseline levels. It provides a useful example of the potential consequences of arduous military training.

The very large energy deficit, and insufficient macronutrient intake presented a practical, relevant, and realistic opportunity to improve dietary intake throughout the course, in order to minimise detrimental changes and enhance recovery following the SF-SC. Therefore, the following actions have been taken in response to the research:

→ Development of SF-SC preparation guide, providing nutrition recommendations to assist future selection candidates to optimise nutrition throughout preparation and during SF-SC

→ Small (but important) changes to provision of food throughout the course, resulting in improvements such as:

- 23% more candidates passed 20km pack march test in 2022, compared to 2021
- 22% reduction in body mass loss and 52% reduction in muscle mass loss in 2023, compared to 2021



Selection Preparation Guide
 Australian Defence Force

