Use of a modified load carriage predictive equation to identify specialist police candidates at greater risk of injury and selection failure

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Published: 11/02/2020

Document Version:
Peer reviewed version

Use of a modified load carriage predictive equation to identify specialist police candidates at greater risk of injury and selection failure

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Introduction

- Tactical personnel are required to carry external loads as part of their everyday occupation. [1]
- This load carriage can increase risk of injury and degrade individual performance. [1]
- Tactical personnel are routinely required to meet strict aerobic fitness requirements. [2]

Purpose

- The aim of this study was to investigate whether a modified predictive equation, based on aerobic fitness and load carriage event parameters, could predict risk of injury during a load carriage event.

Methods

- Retrospective data were collected from 18 specialist tactical police officer candidates attending a selection course within an Australian law enforcement agency
- Baseline data were provided for 20-meter Multi-Stage Fitness Test (20m-MSFT) performance (converted to est. VO_{2max}), time to complete a 10 km pack march carrying a load of 25 kg in a backpack and 3.5 kg in the hands, the 10 km pack march course terrain profile, and outcomes (pass or fail) of the candidate on the tactical police selection course.
- Baseline data were then entered into a load carriage energy cost equation, modified to account for loads in the hands and on the feet, to determine the % of VO_{2max} work effort (Figure 1) and scored on a risk matrix for load carriage (Table 1) based on earlier work by Orr and Pope [1].

RISK LEVEL MATRIX

LIKELIHOOD	IMPACT				
	Catastrophic	Critical	Serious	Disruptive	Minor
Almost Certain	1 - Extreme	2 - Extreme	5 - High	9 - Substantial	16 - Medium
Likely	3 - High	4 - High	8 - Substantial	14 - Medium	21 - Low
Occasional	6 - Substantial	7 - Substantial	12 - Medium	15 - Medium	23 - Low
Rare	10 - Medium	11 - Medium	13 - Medium	20 - Low	24 - Low
Highly Improbable	17 - Low	18- Low	19 - Low	22 - Low	25 - Low

Table 1: Risk Level Matrix derived of the international Risk Management Framework.

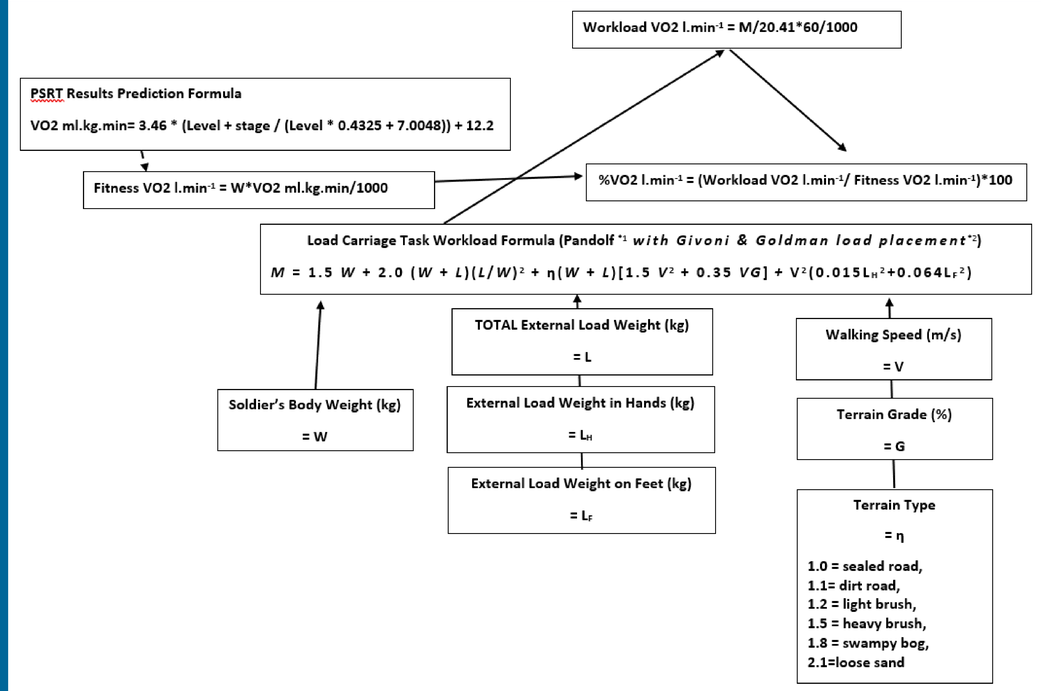

Figure 1: The modified predictive equation: This equation was proposed by Orr et al. [3] and is based on the work from Soule and Goldman [4], Pandolf et al. [5] and Givoni and Goldman's [6] through employing key elements from this previous research.

Results

- Descriptive results from the outcome measures are shown in Table 2.
- Of the 18 participants, 11 passed the selection course (mean height =181.36 ± 5.35 cm: mean weight=85.36 ± 6.65 kg) while seven (mean height=187.42 ± 4.5 cm: mean weight=95.85 ± 7.44 kg) failed.
- Seven participant's work efforts exceeded a predicted work effort of 60% VO_{2max} and of these seven, five failed the selection course. Likewise, 71% of those who were considered to be at moderate risk or higher were injured (Figure 2).

Measure	Mean ± Standard Deviation
Height (cm)	183.72 ± 5.78
Participant mass (kg)	89.44 ± 8.65
Relative load (%)	28.19 ± 2.65
Beep test (level)	11.48 ± 1.06
External Load (kg)	25 kg
Load in hands (kg) (Mock rifle weight)	3.6 kg
Loads on feet (kg) (mean boot weight)	1.2 kg
Beep test score converted to VO_2 max (ml/min/kg)	52.01 ± 3.23
10 km pack march + 25kg pack (mins:sec)	87.00 ± 2.31
10 km pack march average speed (m/s)	1.85 ± 0.07
Metabolic cost (watts)	921.66 ± 89.64
VO_2 (l.min)	2.17 ± 0.26
Predicted work effort as percentage of VO_2 max (%)	58.61 ± 5.84
Terrain type	1.1
Grade (%)	0

Table 2: Descriptive data of all measures

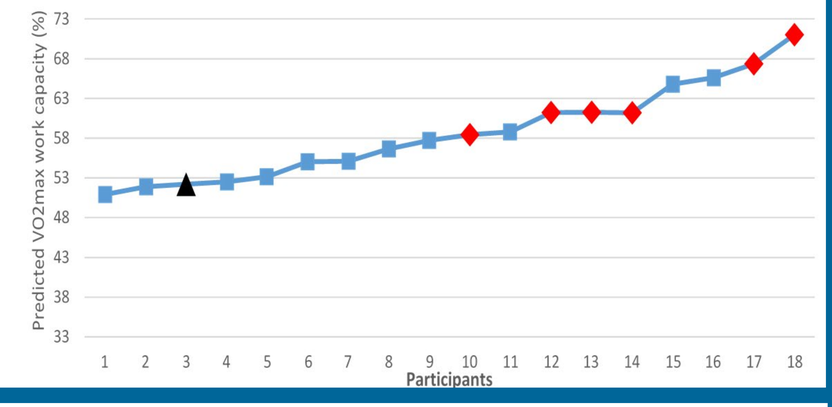

Figure 2: Candidate predicted VO_{2max} work effort based on the modified equation and their selection success. Red markers indicate course failure. The black marker indicates self-withdrawal.

Conclusion

Modified load carriage equations may be of use in identifying specialist candidates at a greater risk of physical injury and subsequent selection course failure.

Operational Relevance

Modified load carriage equations, like the one proposed in this program of research, may augment initial selection processes to identify specialist candidates at a greater risk of injury and selection failure.

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