The perceived effect of load carriage on marksmanship in the tactical athlete

Orr, Rob Marc; Poke, D.; Stierli, Michael; Hinton, Benjamin

Published in:
Journal of Science and Medicine in Sport

DOI:
[10.1016/j.jsams.2015.12.354](https://doi.org/10.1016/j.jsams.2015.12.354)

Licence:
CC BY-NC

[Link to output in Bond University research repository.](#)

Recommended citation (APA):
Orr, R. M., Poke, D., Stierli, M., & Hinton, B. (2015). The perceived effect of load carriage on marksmanship in the tactical athlete. *Journal of Science and Medicine in Sport*, 19 (supplement), e92.
<https://doi.org/10.1016/j.jsams.2015.12.354>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

For more information, or if you believe that this document breaches copyright, please contact the Bond University research repository coordinator.

The perceived effect of load carriage on marksmanship in tactical athletes

Poke D¹, Orr RM¹, Stierli M², Hinton, B³

1 Tactical Research Unit, Bond University, Gold Coast

2 NSW Police Force

Introduction

- Tactical operators required to carry heavy loads (Carbone et al., 2014)
- Mobility & marksmanship must not be negatively affected
- Inconsistent reports on impacts of load carriage on marksmanship accuracy (Knapik et al., 1991; Rice et al., 1999; Carbone et al., 2014)
- Australian Army soldiers perceive negative impacts (Orr et al., 2013)
- How do SWAT perceive the impacts? Are they accurate?

Methods

- Six men – Police Tactical Operations Unit (SWAT)
- Fatigues Only (FO)
- Tactically Loaded (TL)
- Short move & mobility task with Primary & Secondary weapon

(FO)

(TL)

Methods

- Distance to centre of target
  - DCOT
- Horizontal shot spread
  - X-Dispersion
- Vertical shot spread
  - Y-Dispersion

Image Source: Carbone et al., 2014

BOND
UNIVERSITY
TACTICAL RESEARCH UNIT

Methods:

- Visual Analogue Scale (VAS)
- Scaled & measured

Subject Number

How do you think tactical load impacts on your marksmanship with the pistol when compared to carrying no load:

How do you think tactical load impacts on your marksmanship with the rifle when compared to carrying no load:

Methods

- Statistics
  - Paired-samples t -tests
  - Pearson's correlation coefficients
  - Alpha levels set at 0.05
- Ethics approval – BUHREC R01585B

Results

- No significant difference when TL

Table 1. Primary weapon marksmanship results from all four conditions

Task & Loading Condition	DCOT (mm)	X-Dispersion (mm)	Y-Dispersion (mm)
Short Forward Movement			
Fatigues Only	75.93 ± 17.97	112.50 ± 31.35	143.58 ± 44.88
Tactically Loaded	70.48 ± 19.57	76.42 ± 46.99	168.42 ± 50.39
Mobility Task			
Fatigues Only	74.83 ± 36.95	116.67 ± 70.05	173.25 ± 139.65
Tactically Loaded	100.10 ± 20.14	112.50 ± 51.59	213.67 ± 70.99

Data are mean ± standard deviation

Table 2. Secondary weapon marksmanship results from all four conditions

Task & Loading Condition	DCOT (mm)	X-Dispersion (mm)	Y-Dispersion (mm)
Short Forward Movement			
Fatigues Only	107.35 ± 37.68	178.33 ± 81.62	206.33 ± 85.87
Tactically Loaded	112.60 ± 44.37	128.83 ± 59.55	188.25 ± 60.23
Mobility Task			
Fatigues Only	128.23 ± 33.20	157.00 ± 70.43	274.08 ± 176.61
Tactically Loaded	108.70 ± 52.48	176.25 ± 70.13	212.08 ± 131.60

Data are mean ± standard deviation

Results

- ❑ Perceived significant improvement in marksmanship when TL
  - ▣ Primary – VAS $+3.00 \pm 2.53$ ($p = 0.016$)
  - ▣ Secondary – VAS $+2.83 \pm 2.93$, ($p = 0.039$)
- ❑ Did not perceive either weapon affected by TL differently

Results

- Moderate negative correlation (negative = improved performance)
  - VAS Primary – MobP-XDisp ($p = 0.247$)

Table 4. Correlation between variables for tactically loaded primary weapon marksmanship

Variable	VAS Primary	ShP-DCOT	MoP-DCOT	ShP-XDisp	MoP-XDisp	ShP-YDisp	MoP-YDisp
VAS Primary	1.000	-0.347	-0.401	-0.288	-0.561	0.190	-0.294
ShP-DCOT	-0.347	1.000	-0.483	0.874*	-0.457	0.394	-0.570
MoP-DCOT	-0.401	-0.483	1.000	-0.210	0.960**	-0.925**	0.817*
ShP-XDisp	-0.288	0.874*	-0.210	1.000	-0.242	0.002	-0.410
MoP-XDisp	-0.561	-0.457	0.960**	-0.242	1.000	-0.806	0.866*
ShP-YDisp	0.190	0.394	-0.925**	0.002	-0.806	1.000	-0.636
MoP-YDisp	-0.294	-0.570	0.817*	-0.410	0.866*	-0.636	1.000

ShP-DCOT = Short move primary weapon DCOT; MoP-DCOT = Mobility task primary weapon DCOT; ShP-XDisp = Short move primary weapon X-dispersion; MoP-XDisp = Mobility task primary weapon X-dispersion; ShP-YDisp = Short move primary weapon Y-dispersion; MoP-YDisp = Mobility task primary weapon Y-dispersion

* Correlations significant at $p < 0.05$

** Correlations significant at $p < 0.01$

Results - Correlations

- Moderate negative correlations
  - VAS Secondary – ShS-DCOT ($p = 0.179$)
  - VAS Secondary – ShS-XDisp ($p = 0.275$)
- High negative correlation
  - VAS Secondary – ShS-YDisp ($p = 0.082$)

Table 5. Correlation between variables for tactically loaded secondary weapon marksmanship

Variable	VAS Secondary	ShS-DCOT	MoS-DCOT	ShS-XDisp	MoS-XDisp	ShS-YDisp	MoS-YDisp
VAS Secondary	1.000	-0.631	-0.306	-0.534	-0.472	-0.756	-0.301
ShS-DCOT	-0.631	1.000	0.238	0.666	0.640	0.524	-0.014
MoS-DCOT	-0.306	0.238	1.000	-0.483	0.604	-0.196	-0.615
ShS-XDisp	-0.534	0.666	-0.483	1.000	0.135	0.804	0.587
MoS-XDisp	-0.472	0.640	0.604	0.135	1.000	0.427	0.032
ShS-YDisp	-0.756	0.524	-0.196	0.804	0.427	1.000	0.778
MoS-YDisp	-0.301	-0.014	-0.615	0.587	0.032	0.778	1.000

ShS-DCOT = Short move secondary weapon DCOT; MoS-DCOT = Mobility task secondary weapon DCOT; ShS-XDisp = Short move secondary weapon X-dispersion; MoS-XDisp = Mobility task secondary weapon X-dispersion; ShS-YDisp = Short move secondary weapon Y-dispersion; MoS-YDisp = Mobility task secondary weapon Y-dispersion

Discussion

- Tactical police perceive improvement in marksmanship when TL
  - In contrast to Orr et al. (2013)
  - ARA soldiers carry heavier loads over greater distances
  - Familiarity & operational requirement increases positive perception
- X-dispersion decreased during TL short move
  - Consistent with Carbone et al., 2014
  - Body armour splint torso & generate low-level muscle activity at shoulder
- Primary weapon DCOT increased during TL mobility task
  - Rifle interaction with torso
  - Increased respiratory rate & vertical chest displacement (Carbone et al. 2014)

Conclusion

- Tactical police officers perceive marksmanship improves when TL
- Trend towards objective marksmanship measures supporting belief
- Key reason and difference to military populations is constant marksmanship while loaded

Practical Applications

- Direction for training tactical operators
  - Marksmanship training in TL condition Carbone et al. 2014
- Monitor perception of load carriage impacts
  - Prevent over-confidence
  - Provide feedback on relationship to performance

References

- Carbone, P. D., Carlton, S. D., Stierli, M., & Orr, R. M. (2014). The impact of load carriage on the marksmanship of the tactical police officer: A pilot study. *Journal of Australian Strength and Conditioning*, 22(2), 50-57
- Knapik, J., Staab, J., Bahrke, M., Reynolds, K., Vogel, J., & O'Connor, J. (1991). Soldier performance and mood states following a strenuous road march. *Military medicine*
- Nieuwenhuys, A., & Oudejans, R. R. (2012). Anxiety and perceptual-motor performance: toward an integrated model of concepts, mechanisms, and processes. *Psychological research*, 76(6), 747-759
- Orr, R. M., Pope, R., Johnston, V., & Coyle, J. (2013). Soldier self-reported reductions in task performance associated with operational load carriage. *Journal of Australian Strength and Conditioning*, 21(3), 39-46
- Rice, V. J., Sharp, M. A., Tharion, W. J., & Williamson, T. (1999). Effects of a Shoulder Harness on Litter Carriage Performance and Post-Carry Fatigue of Men and Women (No. USARIEM-T-00-7). Army Research Inst of Environmental Medicine, Natick, MA.