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

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The perceived effect of load carriage on marksmanship in tactical athletes

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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)

Image Source: NSW Police




Methods

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

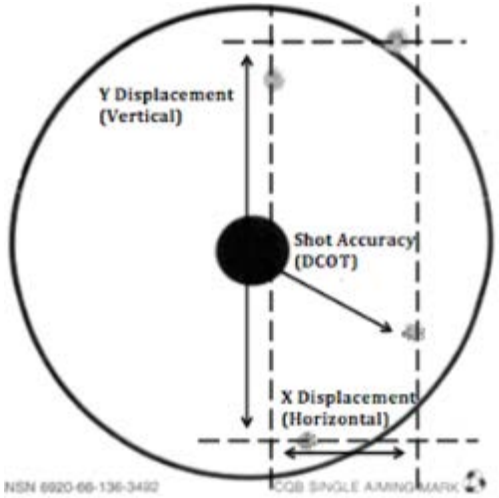

Image Source: Carbone et al., 2014

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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:

-10 0 +10

Worse No Change Better

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

-10 0 +10

Worse No Change Better




Methods

- Statistics
  - Paired-samples *t*-tests
  - Pearson's correlation coefficients
  - Alpha levels set at 0.05
- Ethics approval – BUHREC RO1585B

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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 ± 2.53 (p = 0.016)
  - Secondary – VAS +2.83 ± 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

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