Pilot Analysis of Strength and Power in Candidates for Officer Candidate School at a Regional USMC Office

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ABSTRACT

The United States Marine Corps (USMC) is the oldest branch of the US military that has a variety of functions, including as an expeditionary unit that is sent out first to a variety of combat zones and crisis areas. Job tasks often require strength and power, like lifting and carrying repair equipment for trucks and tanks and loading a variety of rounds that weigh anywhere from ~16-61 kg (1). In an attempt to ensure all active and on-duty Marines have the appropriate physical fitness needed for combat, the USMC created the Physical Fitness Test (1) (PFT), which includes a maximum pull-up test, timed plank, and a 3-mile run. The PFT is also used as the barrier to entry into Officer Candidate School (OCS) (3). These events in the PFT may not measure strength and power. Indeed, strength and power are not commonly measured in USMC candidates before arrival at OCS or basic training. Establishing strength and power measures in candidates while they are training at regional offices may help guide training staff and candidates on how to prepare before they arrive for OCS. **PURPOSE:** To analyze strength and power measurements in male and female USMC candidates from a regional USMC office preparing for OCS. **METHODS:** Sixteen USMC candidates (11 men, 5 women) from one regional office training to be selected for OCS and the PFT volunteered for this study. Candidates participated in one testing session to measure strength (hand grip, leg/back dynamometer) and power (vertical jump [VJ],], standing broad jump [SBJ] ,2-kg medicine ball throw [MBT]). Peak power was also calculated from VJ height. Independent t-tests ($p < 0.05$) were run on the strength and power measurements to compare the male and female candidates. Partial correlations controlling for sex ($p < 0.05$) were used to calculate relationships between strength and power measurements. **RESULTS**: Male candidates performed significantly better on all strength and power tests ($p \leq 0.02$), except on the relative handgrip, compared to the female candidates. There were eight significant partial correlations between the strength and power measures The leg/back dynamometer had a significant relationship with VJ power (large relationship), MBT (moderate relationship), VJ (moderate relationship), VJ power relative (moderate relationship). The LBD relative had a significant relationship with the VJ (moderate relationship) and VJWR (moderate relationship). The hand grip had a significant relationship with the VJ power (moderate relationship). No other partial correlations were significant. **CONCLUSIONS:** Female candidates from this regional office may require more specific strength and power training before arriving for OCS than male candidates due to the gap in strength and power between the sexes. Notably, there were only two significant partial correlations within the candidate sample. This could mean that USMC candidates may need to train specifically for both strength and power and not just one of the attributes, since higher strength did not always correlate with higher power. **PRACTICAL APPLICATIONS:** The pilot data provides insight on the typical strength and power measurements of candidates preparing for OCS at a regional USMC office. Although candidates may focus on training for the PFT when preparing with USMC regional office training staff, they should complete strength and power training as well as this will prepare them for future training and job demands. Female candidates in particular may need to develop these qualities. Strength and power may also need to be developed specifically in USMC candidates, as greater strength may not always translate to greater power.

INTRODUCTION

- Members of the United States Marine Corps (USMC) have to complete a variety of physically demanding tasks that require strength, power and endurance (1). Some example tasks include casualty carries, ammunition resupply, assembling and mounting heavy artillery equipment, digging fighting holes, and long ruck walks (1).
- These physically demanding tasks typically require power and strength in order to be completed efficiently in combat or in preparation for combat. In an attempt to ensure that all active and on-duty Marines have the appropriate physical fitness (i.e., muscular strength stamina and aerobic capacity) needed for combat, the USMC created the Physical Fitness Test (PFT) (6).
- Three events are included in the PFT: maximum pull-ups which is used to assess the muscular strength endurance of the upper body; a timed plank which is capped at 3 minutes and 45 seconds which measures the muscular endurance of the trunk; and a 3-mile (4.83-km) run which tests the efficiency of the cardiovascular system (6).
- The issue with the PFT does not test attributes such as strength and power that may be necessary to complete the physically demanding tasks required by a USMC member (1). USMC candidates typically focus their training on improving their PFT score which may lead them to neglect developing their strength and power.
- Women have been part of the USMC since 1918 in a variety of roles (6). However, women have only had the opportunity to be part of combat units since 2013 (6). It is important to analyze and compare strength and power measures between male and female USMC candidates, as they may end up completing similar roles in the service.
- The purpose of this study was to analyze strength (isometric hand grip and leg/back dynamometer [LBD]) and power measurements (vertical jump [VJ], standing broad jump [SBJ], and 2-kg seated medicine ball throw [MBT]) in male and female USMC candidates preparing for Officer Candidate School (OCS) who have been training at a regional office.

METHODS

- Sixteen USMC candidates (age: 23.13 ± 2.60 years; height: 171.91 ± 7.26 cm; body mass: 72.45 ± 12.28 kg) currently training at a regional office in preparation to be selected into the USMC OCS were analyzed.
- Strength was measured by absolute and relative combined hand grip and leg/back dynamometer measures (4). Power was analyzed by measuring VJ, VJ power, VJ relative power, SBJ, and the MBT (3,5). VJ power was calculated using the Sayers equation (Peak power (Watts) = 60.7 × jump height (cm) + 45.3 × body mass (kg)—2055) (7).
- Descriptive statistics (mean ± standard deviation [SD]) were calculated for each variable. Independent samples t-tests ($p < 0.05$) and effect sizes (d) were used to compare male and female participants in all variables. Partial correlations ($p < 0.05$) controlling for sex were used to calculate the relationships between the strength and power measurements. Correlation strength was defined as r between 0 to ±0.3 as small; ±0.31 to 0.49, moderate; ±0.5 to 0.69, large; ±0.7 to 0.89, very large; or ±0.9 to 1, near perfect for relationship prediction (2).

RESULTS

- The data for male and female groups are shown in Table 1. Male candidates were taller (large effect) and heavier (very large effect) than female candidates. Male candidates performed significantly better on all strength and power tests (large effect to very large effect), except for relative hand grip (moderate effect).

Table 1. Descriptive data (mean ± SD) for age, height, mass, and strength (leg/back dynamometer [LBD], relative LBD, hand grip, relative hand grip) and power (vertical jump [VJ], VJ power, relative VJ power, standing broad jump [SBJ], medicine ball throw [MBT]) variables in male and female USMC OSC candidates.

	Males (n = 11)	Females (n = 5)	p	d
Age (years)	23.64 ± 2.76	22.00 ± 2.00	0.25	0.63
Height (cm)	175.09 ± 5.52	164.09 ± 5.70*	0.04	1.82
Body Mass (kg)	78.12 ± 8.42	59.84 ± 9.94*	0.02	2.06
Hand grip (kg)	103.45 ± 12.88	64.60 ± 13.55*	<0.01	2.97
Relative Hand Grip (kg/body mass)	1.31 ± 0.20	1.08 ± 0.18	0.05	1.15
LBD (kg)	174.35 ± 25.28	109.32 ± 19.20*	<0.01	2.70
Relative LBD (kg/body mass)	2.24 ± 0.31	1.82 ± 0.37*	0.03	1.25
VJ (cm)	50.89 ± 9.11	37.46 ± 3.23*	0.01	1.69
VJ Power (watts)	4574.09 ± 722.20	2929.20 ± 371.90*	<0.01	2.50
Relative VJ Power (watts/body mass)	58.53 ± 6.53	49.25 ± 3.73*	0.01	1.57
SBJ (m)	2.23 ± 0.28	1.67 ± 0.13*	0.01	2.27
MBT (m)	6.18 ± 0.65	4.19 ± 0.73*	<0.01	2.94

* Significantly ($p < 0.05$) different from the male candidates.

- There were eight significant relationships between the strength and power measures (Table 2). Absolute LBD had a significantly correlated with VJ (moderate relationship), VJ power (large relationship), relative VJ power (moderate relationship), and MBT (moderate relationship). Relative LBD significantly correlated with VJ and relative VJ power (both moderate relationships). Hand grip had a significant correlation with VJ power (moderate relationship).

Table 2. Correlation data between strength (hand grip, relative hand grip, leg/back dynamometer [LBD], relative LBD) and power (vertical jump [VJ], VJ power, relative VJ power, standing broad jump [SBJ], and 2-kg medicine ball throw [MBT]) variables.

		VJ	VJ Power	Relative VJ Power	SBJ	MBT
Hand Grip	r	0.42	0.57	0.39	0.09	0.30
	p	0.11	0.02*	0.14	0.74	0.26
Relative Hand Grip	r	0.32	<0.01	0.46	0.20	0.02
	p	0.24	0.98	0.08	0.48	0.99
LBD	r	0.68	0.72	0.55	0.08	0.65
	p	0.01*	<0.01*	0.03*	0.76	<0.01*
Relative LBD	r	0.51	0.15	0.63	0.20	0.36
	p	0.04*	0.59	0.01*	0.47	0.17

* Significant ($p < 0.05$) relationship between the two variables.

CONCLUSIONS

- Female candidates from this regional office may require specific strength and power training before arriving for OCS due to the gap in strength and power between the sexes (8).
- Only eight of 20 correlations were significant between the strength and power tests within the sample. Notwithstanding the use of both upper and lower body tests, this data could mean that USMC candidates may need to train specifically for both strength and power and not just one of the attributes, since higher strength did not always relate to with higher power.
- Seven out of the eight partial correlations came from the absolute and relative LBD. The strength of these relationships were moderate to large, which suggests that increasing strength as measured by the LBD could positively influence total body power. Both male and female USMC candidates should target lower body strength development as part of their preparation for OCS.

PRACTICAL APPLICATIONS

- The pilot data provides insight on the typical strength and power measurements of candidates preparing for OCS at a regional USMC office. Although candidates may focus on training for the PFT when preparing with USMC regional office training staff, they should complete strength and power training as well as this will prepare them for future training and job demands. Female candidates in particular may need to develop these qualities. Strength and power may also need to be developed specifically in USMC candidates, as greater strength may not always translate to greater power.

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