Original Paper DOI: https://doi.org/10.5114/biolsport.2019.83506

Age-related influence on physical fitness and individual on-duty task performance of Portuguese male non-elite police officers

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ABSTRACT: (a) to analyse the effect of age on physical fitness (PF) and on-duty task (ODT) performance of male police officers (PO); (b) to analyse the relationship between PF and ODT performance of male PO; and (c) to identify the set of PF attributes which better predicts the ODT performance of male PO. A total of 97 Portuguese male non-elite PO (Public Security Police) took part in this cross-sectional study. Participants were allocated to four age categories (20-29, 30-39, 40-49, and >49 years old), and performed fourteen PF evaluations and one on-duty task simulation test (ODT-ST). MANOVA, partial correlations and multiple linear regression analysis were used. We observed (a) a significant decrease of performance with aging (PF attributes, partial eta-squared=0.763; total time on ODT-ST, partial eta-squared=0.498); (b) significant positive associations between body mass index and fat mass with total time on ODT-ST; (c) a significant negative association between standing broad jump (SBJ), sit-up, push-up, bench-press ratio and aerobic capacity with total time on ODT-ST; and (d) that SBJ, abdominal muscular endurance and aerobic capacity were significant predictors of total time on ODT-ST (R^2=0.983). PF attributes and ODT performance of Portuguese male non-elite PO decrease significantly with aging. To prevent the observed decrease of performance it seems advisable to implement regular strength and conditioning programmes, which should include muscular power, core strength and aerobic fitness development, to maintain physical capacity and occupational duties.

CITATION: Teixeira J, Monteiro L, Silvestre R et al. Age-related influence on physical fitness and individual on-duty task performance of Portuguese male non-elite police officers. Biol Sport. 2019;36(2):163–170.

Received: 2018-07-28; Reviewed: 2018-11-30; Re-submitted: 2019-02-17; Accepted: 2019-02-17; Published: 2019-03-14.

Key words:
Aging
Cardiorespiratory fitness
Fitness testing
Law enforcement
Muscle strength
Work performance

INTRODUCTION

During the last years, sport scientists have shown an increasing interest in the study of tactical populations [1-10]. Nevertheless, the literature in the area is not abundant, and research on factors that influence Portuguese police officers' (PO) performance is still lacking in the literature.

Previous studies on physical fitness (PF) attributes and PO performance [6-10] have reported that a steady set of attributes underlie the most frequent and critical tasks identified in PO duties [6]. Tasks such as foot pursuits, crawling under, or through obstacles, dodging, jumping and vaulting over obstacles, lifting and pushing/pulling objects, climbing stairs and fences, dragging victims and sustained use-of-force situations were associated with fitness attributes such as cardiorespiratory endurance, anaerobic power, upper-body strength, explosive leg power, muscular endurance, muscular strength, agility and flexibility [7-10].

Based on current knowledge on PO performance, the ODT simulation tests (ODT-ST) [1] represent a valid replacement of real on-duty tasks to understand better the relevance of PF attributes for the actual job performance of PO [2-5]. This ODT evaluation integrates a number of physically demanding tasks, based on those deemed to be the most frequent and critical tasks in the police work, and is considered to be a valid evaluation method to ascertain the ability of PO to perform their job.

In fact, the minimum standards to perform police work will remain the same, regardless of age groups, and will only be based on the demands of the ODTs. However, newly graduate PO are physically fit to fulfil the demands of everyday police work but the decrease in PF [11,12] after graduation can be viewed as somewhat problematic (i.e., a sign of inadequate capacity to perform the ODT). Nevertheless, whether PF and ODT performance changes through the careers of PO remains an unanswered question [8,9,13,14], particularly in Portuguese PO.

Taking into account all the above, two conditions need to be studied: (a) the impact of age and, (b) the predictive and important variables of ODT performance. In accordance, this study aims: (a) to analyse the effect of age on PF attributes and ODT performance of male PO; (b) to analyse the relationship between PF attributes and ODT performance; and (c) to identify the set of PF attributes which better predicts the ODT performance of male PO. Thus, our hypothesis was that PF and ODT performances of Portuguese male non-elite PO decreases through their careers, and that the development of a set of PF attributes can be effective in slowing this deterioration.

MATERIALS AND METHODS

Participants

A total of 97 Portuguese male non-elite PO (Public Security Police, PSP) took part in this cross-sectional study. Participants were allocated to four chronological age categories (20-29, 30-39, 40-49, and >49 years old) [11], and data related to service time in the PSP were registered (see Table 1). All participants received a clear explanation of the aims and procedures of the study and signed an informed consent form before the start of data collection. This study was authorized by the Ethics Commission of the Higher Institute of Police Sciences and Internal Security (Lisbon, Portugal, Europe), and experiments reported in the manuscript were performed in accordance with the ethical standards of the Helsinki Declaration.

Study Design

Medical conditions, such as injury or fever that could affect the results of this cross-sectional study, were an exclusion criterion, and the Physical Activity Readiness Questionnaire (PAR-Q) was applied to ensure that voluntary PO were able to perform the battery of tests. The tests battery used in this study covered PF evaluations [7-10] and one ODT simulation test – ODT-ST [1,2] (Figure 1). Information about the PF tests and ODT-ST was sent to the volunteers two weeks prior to evaluation. Each participant was required to attend one familiarization session and one experimental testing session. Investigators were responsible for data collection and correct execution of all testing protocols. All the tests were performed indoors, at the same facilities (November/December), and data were directly collected by the investigators, following predetermined protocols described hereafter. Participants were instructed to avoid strenuous physical activity and substances containing caffeine or alcohol, in the 24 h before each testing session.

Morphological Evaluations

Height (cm) and body mass (kg) were measured according to the protocol described by Marfell-Jones et al. [15], and the norms established by the International Society for the Advancement of Kinanthropometry (ISAK). Body mass was measured to the nearest 0.5 kg, using a Secca body scale, model 761 7019009 (Vogel & Halke, Hamburg, DE), and height was measured to the nearest mm (0.1 cm) using a Siber-Hegner anthropometric kit (DKSH Ltd., Zurich, SW). Complementarily, body mass index (BMI) was calculated from body size measurements, i.e.: BMI = (body mass) / ($height^2$). Individual measurements were collected, in all participants, by the same ISAK evaluators (intra-observer technical error of measurements: height, $R \geq 0.98$). In the study of body composition relative fat mass (%FM) was considered; i.e., the %FM data was assessed with a segmental multifrequency bioimpedance analyzer (Tanita BC-601, Tanita Corp., Tokyo, Japan) with measurements obtained as described by the manufacturer.

Fitness Evaluations

Before the fitness tests, all participants performed a 20-minute standardized warm-up routine, and between tests the participants were allowed 10 minutes of passive rest. All participants completed seven fitness tests, from which 10 variables were collected for analysis.

Handgrip strength. Participants completed a maximal isometric handgrip strength test at baseline using a digital dynamometer (Smedley Takei TKK 5401 Grip-D, Tokyo, Japan). The subject was seated with the elbow flexed at 90º and performed two maximal contractions in each hand in an alternating fashion with a 60-s rest period between each contraction. Maximal isometric strength of both hands was calculated, and the sum of the right- and left-hand strength was registered (in kg).

Vertical jump. Participants were evaluated according to the Bosco protocol [16], and measured using Chronojump measurement technology (Bosco System, Globus, Italy). Participants carried out two countermovement jumps (CMJ), and height (cm), power (P_{max}; Watts, W) and velocity (V_{max}; m/s) of the best attempt were recorded.

Standing broad jump. The subject was asked to stand behind the starting line with the feet parallel to each other and instructed to jump as far as possible by bending the knees and swinging the arms. Maximum distance measured to the nearest cm was the score and the best of two trials was recorded [10].

Abdominal strength. It was assessed using the 60-s sit-up test [17]. At the bottom position the shoulder blades had to touch the ground, and at the top the elbows had to touch the knees. The start and finish commands were given by the investigator, who then registered the number of repetitions. Participants were allowed to rest in the down position, but only complete repetitions were counted (i.e., repetitions not meeting the correct format for the sit-up were not counted). Participants completed one trial and the number of repetitions was recorded.

Upper-body strength endurance. It was assessed using the 60-s push-up test. After assuming the "up" position, with arms fully extended, hands on the floor placed shoulder-width apart and planked body, the start command was given by the investigator. The subject had to lower his body, flexing his elbows, so that his chest touched the investigator's fist, placed directly below it. They then had to return to the fully extended arm position to complete a full repetition.

Participants were allowed to rest in the "up" position and only complete repetitions during the 60-s period were registered (i.e., repetitions not meeting the correct format for the push-up were not counted).

Maximum and relative upper-body strength. The 1RM bench press test was implemented [2,6-10,18]. The predetermined weight used was according to 70% of the subject's body mass. If the subject could not perform a single repetition, a decrease of 10 kg was made for the next try. If the participant performed 10 (or more) repetitions with that weight, an increment of 10 kg was added for a new set. New attempts were made after a 3-minute rest period. A full repetition required the participant to lower the bar from the full extended arms position until it touched his chest, then returning to the full extended arm position. The number of repetition achieved, between 1 and 10, was then integrated into Epley's formula for determining the 1RM bench press assessing maximum upper-body strength (1RM = W x (1 + (repetitions / 30)), repetitions >1) [19-21]. The relative upper-body strength was calculated through the ratio between the 1RM mark and the subject body mass (1RMratio = (1RM) / (body mass)).

Aerobic capacity. The non-exercise method was used in order to prevent the fatigue caused by any exercise-based test to determine VO_{2peak} to impair the results of the ODT-ST. The Jackson non-exercise VO_{2peak} prediction model, based on body mass index, was used after determining the physical activity rating (PA-R) through a questionnaire [22]. This instrument has proven to be very reliable and an easy way to determine aerobic capacity for heterogeneous samples [22,23].

On-Duty Task Evaluation

The individual ODT performance was evaluated with one ODT-ST. The ODT-ST was not part of the recruit PO academy, and participants performed a familiarization session and one experimental testing session (see study design).

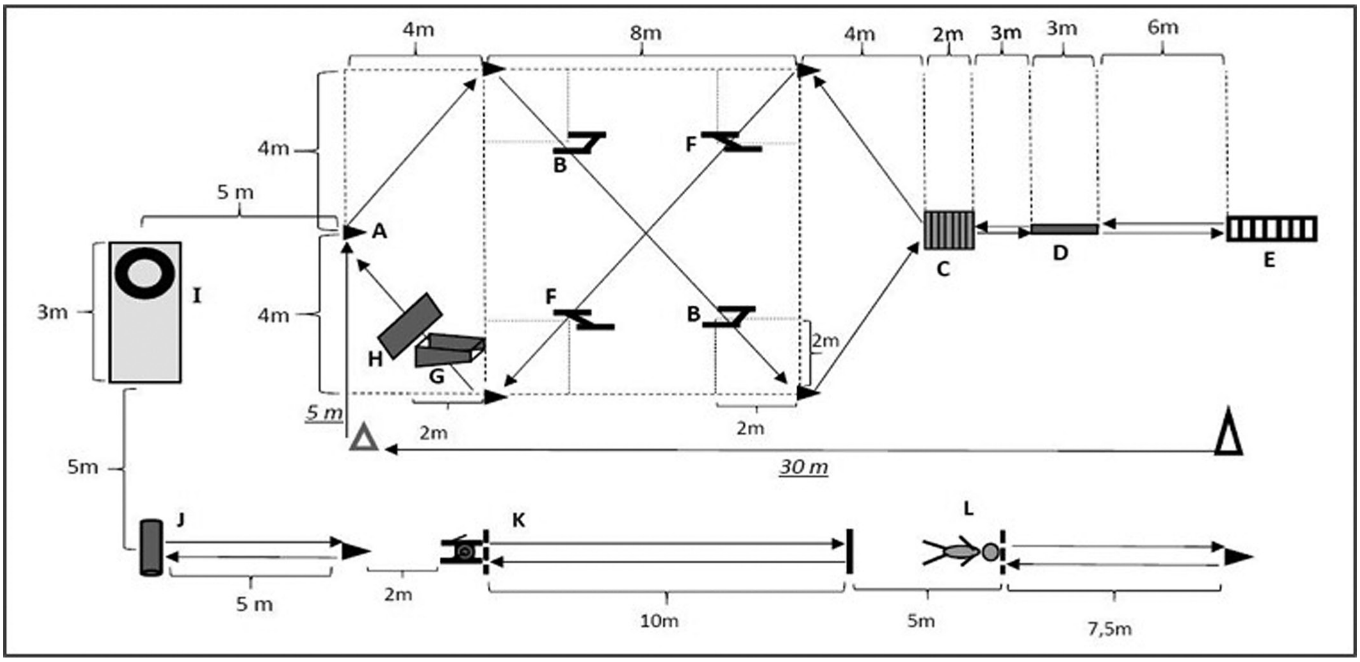

FIG. 1. ODT-ST for Portuguese non-elite PO (layout and executive description).

EXECUTIVE DESCRIPTION

(1) PURSUIT STAGE:

Δ - Starting point, runs 30 m to get to Δ, right turn and run another 5 m;

▲ - Course indicating pylons (to go around the outside);

A - Pylon indicating the start/end of the 4 laps to obstacle course;

B – 0.75-m hurdles to go under;

C – six-step staircase to go up and down;

D – 3-m long, 0.3-m wide balance beam;

E – Gym ladder to climb and reach a mark set at 3.2 m high;

F – 0.45-m hurdles to go over (no support);

G – 1.5-m high plinth to go over (using hands and feet);

H – gym mat to perform controlled falls (alternating front and back in each of the 4 laps).

(2) REST (30 seconds).

(3) SOLVING STAGE:

I – 65-kg tyre to flip 4 times;

J – 25-kg bag to carry for 5 m, around the pylon and back;

K – 45-kg sled (total) to push for 10 m, and to pull back another 10 m (using cable);

L – 48-kg dummy to drag/carry for 7.5 m, around the pylon and back.

(4) END OF TEST.

A period of 30 minutes of rest was granted before the start of the ODT-ST. During this period, PO would change from training gear (shorts, t-shirt and sneakers) to operational gear (PSP issued tactical garment and boots) in which they would perform the ODT-ST. A tactical utility belt holding a baton, handcuffs and mock gun was given to be carried during the simulation. This equipment is considered to be the essential gear for general PO and is also the gear that law enforcement agencies provide to their POs [2]. The total weight of the belt was 2.4 kg, with the mock gun weighing the same as the issued Glock 19 (Ferlach, Austria) with a fully loaded magazine (850 g).

The ODT-ST comprised two stages (see Figure 1). The first stage was supposed to mimic a foot pursuit during which the subject, in full tactical gear, would have to: (a) sprint for 35 m; (b) enter an obstacle course enclosed with cones to go around, where he had two 0.75-m barriers to crawl under; (c) a set of stair to go up and down; (d) a 3-m beam to balance across; (e) a gymnasium ladder to climb and reach a mark set at 3.2 m high; (f) two 0.45-m barriers to jump over; (g) a 1.5-m high plinth to go over; (h) a mat to perform one controlled fall on each lap (alternating between falling on his chest and on his back). After completing 4 laps of this course, a 30-s rest period was granted. After that, participants would initiate the second stage, simulating the solving of the problem, where the PO should: (a) flip a 65-kg tyre four times; (b) lift and carry a 25-kg bag for 10 m; (c) push a 45-kg sled for 10 m and pull it on his way back another 10 m; and (d) drag/carry a 48-kg dummy for 15 m. The total distance of the ODT-ST was 393 m, and the final time was recorded and registered. A previous study (unpublished) showed that ODT-ST total time yielded an intraclass correlation coefficient (ICC) of 0.824 (95%CI: lower = 0.662; upper = 0.912) and a Cronbach's alpha coefficient of 0.903.

Data Analyses

All analyses were performed using the SPSS software (Version 23.0, IBM SPSS, Chicago, IL), and the significance was set at 5%. Participants were stratified by age categories: 20-29, 30-39, 40-49, and >49 years old [11]. Basic descriptive statistics (mean and standard deviation) were calculated for all the variables, which also were examined for normality by the Shapiro-Wilk test and homogeneity of variances by the Levene test. Multivariate analysis of variance (MANOVA) was performed to test the effect of age on PF attributes. Post hoc tests, with Bonferroni adjustment for multiple comparisons, were used in case of a significant effect. In addition, ANOVA was performed in order to examine the potential effect of age categories on ODT-ST total time. The magnitude of effect size was estimated using partial eta squared (η^2_p) with cut-off scores adapted from Cohen [24], i.e.: ≤0.05 (small); 0.05–0.25 (moderate); 0.25–0.50 (large); >0.5 (very large). In continuation, partial correlations were calculated to analyse the correlation between PF attributes and ODT performance (using age as a covariate). Finally, multiple linear regression analysis was conducted to examine the relationships between ODT-ST performance (independent variable) and a set of predictor variables including age categories (dependent dummy variables; enter method) and PF attributes (dependent variables; forward stepwise method).

RESULTS

Descriptive data (mean ± SD) of age, service time, PF measures and ODT-ST performance by age categories are presented in Table 1. Significant very large effect sizes of age categories were observed for: (a) PF variables (Roy's largest root = 3,214; $F(13,83) = 20.523$; $p < 0.001$; $\eta^2_p = 0.763$; $\varpi = 1.000$); and (b) SBJ ($F(3,93) = 37.123$), abdominal muscular endurance ($F(3,93) = 40.135$), aerobic capacity ($F(3,93) = 53.144$), and ODT-ST performance ($F(3,93) = 30.750$) (i.e., performance decrease in older age categories).

Pearson and partial correlation coefficients between ODT-ST performance (total time) and PF attributes are presented in Table 2. Pearson correlations showed: (a) significant positive correlations between morphological attributes (i.e.: body mass index, and relative fat mass) with total time on ODT-ST; and (b) significant negative correlations between height and all studied PF attributes with total time on ODT-ST. Partial correlation analysis showed that age explains the observed correlation between a set of PF attributes (i.e.: height, handgrip, CMJ, and bench press – 1RM) and total time on ODT-ST.

Table 3 features the multiple regression model showing predictor variables for ODT-ST performance. Multiple linear regression analysis entering age categories (enter method) and PF attributes (stepwise method) showed that SBJ, abdominal muscular endurance and aerobic capacity were significant predictors of performance on ODT-ST ($F(7,90) = 743.704$, $p = 0.049$; $R^2 = 0.983$), i.e., total time on ODT-ST increased in older age categories (participants in the >49-year-old category took ~29 s more than those in the 20-29-year-old category), and decreased 6.7 s for each 10 cm in SBJ, 1.5 s for each sit-up and 1.9 s for each ml/kg/min in VO_{2max}.

DISCUSSION

This cross-sectional study showed a very large effect of age (performance decrease in older age category) over standing broad jump (SBJ), abdominal muscular endurance, aerobic capacity and ODT-ST performance. In fact, the reported PF attributes were significant predictors of total time on ODT-ST.

The literature emphasizes that human muscular strength decreases with the aging process [25], and previous studies showed that isometric strength and power decreased with age, especially in groups above 40 years old [26,27]. The reported age-related influence on strength decrease seems to be explained, to a great extent, by the reduction of muscle mass (reduction in the size and/or number of individual muscle fibres, especially of fibre type IIb) [27], related perhaps to: (a) changes in hormone balance [28]; and (b) the decrease in intensity of daily physical activities [29].

Aging also leads to a considerable decrease in explosive strength, particularly in the lower limbs [30,31]. In fact, chronological age

TABLE 1. Descriptive data (mean ± SD) of Portuguese male non-elite police officers stratified by age categories, and results of multivariate analysis of variance – MANOVA for PF attributes and ODT-ST performance.

	Age Categories (years-old)				Statistics			Post hoc					
	20-29	30-39	40-49	>49	p	η^2_p	ϖ	1-2	1-3	1-4	2-3	2-4	3-4
N	43	24	20	10	-	-	-	-	-	-	-	-	-
Age (years)	25.19±2.65	33.29±2.77	44.65±3.18	52.30±2.26	-	-	-	-	-	-	-	-	-
Service Time (years)	2.67±2.00	9.29±3.80	21.80±3.30	28.10±2.47	-	-	-	-	-	-	-	-	-
PHYSICAL FITNESS						MANOVA							
Stature (m)	1.77±0.05	1.77±0.06	1.74±0.05	1.74±0.06	0.033	0.089	0.696						
Body mass (kg)	78.76±7.05	80.47±8.18	83.53±14.39	80.34±10.19	0.339	0.035	0.297						
Body mass index (kg/m^2)	25.01±1.79	25.59±2.44	27.76±3.57	26.58±3.19	0.001	0.153	0.936	*			*		
Relative fat mass (%)	14.69±4.17	17.97±4.29	22.16±4.90	23.11±6.16	<0.001	0.356	1.000	*	*	*	*	*	
Handgrip (kg)	114.34±12.04	104.79±13.47	106.63±15.12	100.58±13.02	0.004	0.133	0.888	*		*			
Countermovement jump - Height (cm)	32.02±5.38	27.79±6.27	24.01±5.46	20.48±5.85	<0.001	0.345	1.000	*	*	*		*	
Countermovement jump - P_{max} (W)	3456.62±409.21	3277.09±419.52	3186.01±688.25	2827.54±646.28	0.005	0.130	0.879			*			
Countermovement jump - V_{max} (m/s)	2.50±0.22	2.32±0.29	2.16±0.23	1.98±0.28	<0.001	0.355	1.000	*	*	*		*	
Standing broad jump (m)	2.22±0.15	2.08±0.11	1.95±0.17	1.69±0.23	<0.001	0.545	1.000	*	*	*	*	*	*
Sit-up 60-s (repetitions)	51.35±8.46	37.79±9.08	30.10±11.66	24.10±5.82	<0.001	0.564	1.000	*	*	*	*	*	
Push-up 60-s (repetitions)	56.02±16.70	38.88±12.93	31.35±15.99	18.70±8.99	<0.001	0.436	1.000	*	*	*		*	
Bench press – 1RM (kg)	95.62±17.82	83.10±18.36	84.7±29.89	64.00±7.02	<0.001	0.189	0.979			*			
Bench press – 1 RM ratio	1.22±0.23	1.04±0.24	1.04±0.43	0.81±0.12	<0.001	0.188	0.979			*			
VO_{2max} (ml/kg/min)	48.94±3.46	45.94±4.18	37.10±6.04	34.30±4.33	<0.001	0.632	1.000	*	*	*	*	*	
ON-DUTY TASK SIMULATION TEST						ANOVA							
Total time (s)	228.63±25.82	251.13±25.51	298.35±65.88	361.10±75.55	<0.001	0.498	1.000		*	*	*	*	*

Partial Eta-Squared (η^2_p): Very large if ^2_p > 0.5; Large if η^2]0.25;0.50]; Moderate if η^2]0.05;0.25]; Small if $\eta^2 \leq 0.05$.

Post hoc: *, $p<0.05$.

showed a significant effect (with relevant differences among all age categories) in SBJ performance. Nevertheless, the effect of age on the 60-s push-up test in law enforcement officers seems contradictory, i.e.: (a) Dawes et al. [11] observed no significant changes between 20- and 59-year-old law enforcement officers; but (b) Sorensen et al. [12], through a follow-up study, found a decrease in general muscular performance of a cohort of law enforcement officers. However, these results could have been a consequence of selection bias (e.g. the Dawes et al. [11] study reported that participants were more physically active).

According to the literature the aerobic capacity decline: (a) occurs between 18 and 53 years old (the 40–44-year-old cohort in whom the effects were most noticeable) [32]; (b) faster above 45 years old [33]; and (c) 19% per decade, between 43 and 70 years old in males [14]. However, a regular training programme proved to be effective in slowing down age-related deterioration [14,33] (reducing it as much as 5% per decade [14]), with an impact on ODT performance.

A systematic review of PF assessment in military and security forces showed that an increase of relative fat mass was correlated with a decrease of ODT performance [34]. Our study was in compliance with these results [9,34], i.e., a positive correlation was observed between relative fat mass and ODT-ST total execution time.

It was also reported in the literature that muscular strength appears to be an important attribute for job performance of PO [4], and previous studies showed that power and strength were the most decisive features for a successful ODT performance [3]. In other words: (a) SBJ performance, an indicator of leg strength and power, seems to be advantageous for the pursuit component (as well as the solving component) of ODT-ST; (b) Stanish et al. [25] and Beck et al. [2] reported the same correlation observed in this study between abdominal muscular strength and two ODT-ST, i.e.: Physical Abilities Requirement Evaluation (PARE) and Officer Physical Ability Test (OPAT), respectively; and (c) Beck et al. [2] and Dawes et al. [11] demonstrated that the performance on the 60-s push-up test was negatively associated with completion time of ODT-ST and suggested that upper-body strength endurance could be a relevant PF feature in police duty. Also, Stanish et al. [25] noted that: (a) the 1RM bench press test performance was significantly correlated with the PARE performance of male PO; and that (b) relative upper-body strength (i.e., 1RM ratio) also proved to be a good predictor of ODT-ST performance (more specifically for participants between 30 and 39 years old). Nevertheless, our results suggested that the first observation can be partially explained by age, which is in agreement with the fact that none of these attributes were selected for the prediction model.

The impact of aerobic capacity on PO performance is well documented [2,35]; hence its use is widespread within the tactical athlete community [34], and our results showed, in accordance with the

TABLE 2. Pearson and partial correlation coefficients (r) between ODT-ST performance and PF attributes of Portuguese male non-elite PO.

	Pearson Correlation		Partial Correlation (Chronological Age*)	
	r	p	r	p
Stature (cm)	**-0.287**	**0.004**	-0.148	0.150
Body mass (kg)	0.184	0.071	0.113	0.273
Body mass index (kg/m^2)	**0.382**	**<0.001**	**0.218**	**0.033**
Relative fat mass (%)	**0.593**	**<0.001**	**0.333**	**0.001**
Handgrip (kg)	**-0.249**	**0.014**	-0.047	0.648
Countermovement jump - Height (cm)	**-0.506**	**<0.001**	-0.141	0.170
Countermovement jump - P_{max} (W)	**-0.247**	**0.015**	0.004	0.972
Countermovement jump - V_{max} (m/s)	**-0.514**	**<0.001**	-0.148	0.151
Standing broad jump (m)	**-0.719**	**<0.001**	**-0.414**	**<0.001**
Sit-up 60-s (repetitions)	**-0.708**	**<0.001**	**-0.418**	**<0.001**
Push-up 60-s (repetitions)	**-0.625**	**<0.001**	**-0.317**	**0.002**
Bench press – 1RM (kg)	**-0.407**	**<0.001**	-0.182	0.076
Bench press – 1RM ratio	**-0.442**	**<0.001**	**-0.218**	**0.033**
VO_{2max} (ml/kg/min)	**-0.718**	**<0.001**	**-0.377**	**<0.001**

*Covariant.

TABLE 3. Final predictive model for ODT-ST performance of Portuguese male non-elite PO, derived from the multiple linear regression analysis entering age categories (enter method) and PF attributes (stepwise method).

Dependent Variable	Independent Variables (Predictors)	Unstandardized Coefficients		Standardized Coefficients	B (95% CI)		R^2	Adjusted R^2	SEE	Sig.
		B	Std. Error	Beta	Lower	Upper				
On-Duty Task Simulation test (total time; in s)	Model 1						0.991	0.982	36.414	0.049
	Age Categories									
	20-29 years-old	547.823	59.391	1.356	429.831	665.814				<0.001
	30-39 years-old	535.437	56.616	0.990	422.960	647.914				<0.001
	40-49 years-old	545.255	51.394	0.920	443.153	647.358				<0.001
	>49 years-old	576.568	46.458	0.688	484.272	668.865				<0.001
	Fitness									
	Sit-up 60-s (repetitions)	-1.456	0.465	-0.233	-2.379	-0.532				0.002
	Standing broad jump (m)	-66.830	27.088	-0.518	-120.645	-13.014				0.016
	VO_{2max} (ml/kg/min)	-1.965	0.986	-0.327	-3.923	-0.007				0.049

literature, the negative correlation between aerobic capacity and ODT-ST execution time (i.e., inferior aerobic capacity results in longer time in ODT-ST).

The multiple linear regression analysis indicates that abdominal muscular endurance, explosive leg power and aerobic capacity are PF attributes that underlie the most frequent and critical tasks in this simulation test of police work. Similar findings were presented by other authors, i.e.: (a) Stanish et al. [25] identified SBJ and 1.5-mile run among the tests that best predicted PARE performance; (b) Arvey et al. [35] identified strength and endurance as the PF domain which better explained police work performance; and (c) Beck et al. [2] showed that aerobic endurance was largely related to campus law enforcement officer ability.

Finally, and in order to improve fitness on duty and make sure that job-related standards are met by on-duty PO [7,9], our outcomes: (a) reinforce the relevance of training programmes, and (b) emphasize the training of muscular power, core strength and aerobic fitness [4]. Nevertheless, some limitations must be considered, i.e.: (a) no female PO were considered in this study; (b) this study was performed in a voluntary setting (selection bias); and (c) aerobic capacity evaluation was non-exercise based. According to this information, further research should: (a) study female PO profile; (b) identify cut-off values of ODT-ST for age categories and minimum PF standards that are predictive of success (more data have to be gathered); and (c) test whether the traditional or non-traditional training programme (considering the above PF attributes) lessens the effect of chronological age on ODT-ST performance.

CONCLUSIONS

This study showed that: (a) PF attributes and ODT performance decrease with aging; and (b) abdominal muscular endurance, standing broad jump and aerobic capacity are predictor attributes of ODT-ST performance of Portuguese male non-elite PO. In accordance, and in order to slow down the observed age-related influence on PF and ODT performance, (a) non-elite PO should be stimulated to perform regular training programmes, and (b) the training programmes should emphasize muscular power, core strength and aerobic fitness, to maintain physical capacity and occupational duties. In sum, the next challenge is to apply and evaluate the effect of a non-traditional training programme on PF attributes and ODT-ST performance.

Acknowledgments

The authors would like to thank all of the participants.

Competing interests' declaration

The authors have no competing interests to declare. No funding was received for this work.

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