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Systematic Review

Biomotor Abilities for Law Enforcement Officer Readiness

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Abstract: Law enforcement officers (LEOs) must maintain a certain level of physical fitness to perform occupational tasks successfully. Because of the wide variation among operators, there does not appear to be a standard fitness test battery that is appropriate to assess occupational fitness for different groups of law enforcement officers. Therefore, multi-faceted fitness assessments are important to evaluate tactical personnel's various essential fitness components, which are often unique to each environment. Fitness standards and training protocols must be developed for each law enforcement agency and customised to the specific audience. This article aims to systematically review the relevant literature to identify biomotor abilities associated with occupational physical ability. This study examined the results of 17 international studies to ultimately synthesise information that (i) aids in the selection of the most used biomotor abilities and occupational physical abilities for LEOs and (ii) serves as a starting point for the development of occupational physical abilities assessment protocols. In conclusion, this study underscores the complex and diverse physical demands on LEOs, advocating for tailored fitness programs and policy reforms to enhance their operational readiness and long-term health.

Keywords: law enforcement officers; occupational physical abilities; biomotor abilities

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1. Introduction

Researchers have reported that most of the on-duty time of law enforcement officers (LEOs) is spent in sedentary activities that are integrated with the performance of brief, infrequent, high-intensity, essential job tasks [1]. The sedentary nature of law enforcement work is typically due to spending extended shift time seated in a patrol car while performing various tasks (e.g., using the mobile data terminal). Despite the sedentary nature of the occupation, a high level of physical fitness remains necessary to effectively perform essential occupational tasks (e.g., civil defence, first responder duties, and rescue situations). Therefore, developing occupationally relevant biomechanical abilities and enhancing technical and tactical skills [2,3] is important to optimise LEO readiness and safety.

The diverse nature of LEO work ranges from patrolling, which involves extended periods of vehicular mobility, to investigative duties requiring prolonged desk work to tactical units with physically demanding tasks. LEOs are required to perform a variety of movement patterns to accomplish job tasks. Specifically, these movement patterns include

balancing, running, jumping, crawling, wrestling, dodging (i.e., agility), climbing stairs and fences, lifting objects, and pushing/pulling objects [1,4–8]. These tasks are typically performed without warning and while wearing personal protective equipment (PPE), which has been shown to adversely affect occupational physical performance [3,4,9,10]. PPE, such as body armour, helmets, and heavy equipment, is necessary for many LEO roles. Prolonged use of such equipment can cause heat stress, reduced mobility, and other physical stressors, emphasising the need for fitness programs that prepare officers for the rigours of prolonged PPE use.

Furthermore, as the physical demands of the job approach an individual's maximum capacity, there is an increased risk of injury leading to disability and increased absenteeism [11,12]. Therefore, maintaining physical fitness to mitigate the health risks associated with their diverse roles' sedentary and active aspects is imperative for LEOs, not only for operational effectiveness. These physically demanding occupational tasks require multiple biomotor skills. However, it is difficult to determine the most relevant biomotor skills from the literature due to differences in the task composition of physical ability assessments, variability in fitness tests, and the type of sample used (i.e., cadet vs. incumbent). Therefore, the purpose of this study was to conduct a systematic review of the relevant literature to identify relevant biomotor skills associated with officers' occupational physical performance. Identifying relevant biomotor skills among the recruit and incumbent law enforcement populations will allow for the development of appropriate fitness assessments to screen law enforcement applicants, assess the readiness of the recruit and incumbent populations, and provide critical information regarding training goals so that appropriate periodisation training strategies can be implemented. Collectively, this information will guide programmatic strategies within law enforcement agencies to enhance officer readiness and safety. Our selection of databases was guided by their prevalence of high-quality, peer-reviewed articles pertinent to law enforcement, physical fitness, and occupational performance. The databases include PubMed, ScienceDirect, and the ISCPSI (Higher Institute of Police Sciences and Internal Security, Portugal) common repository. Each platform was chosen based on extensive coverage of physiological and occupational health literature, ensuring a comprehensive retrieval of relevant studies.

This systematic review is underpinned by a straightforward research question to identify the specific biomotor abilities most predictive of a successful occupational performance among law enforcement officers. It seeks to illuminate how the physical fitness components of LEOs, including those necessitated by the use of personal protective equipment, correlate with their ability to perform essential job tasks effectively. The overarching aim of this study is to synthesise existing literature to establish a comprehensive understanding of the physical fitness requirements for law enforcement officers. This endeavour aims to bridge existing knowledge gaps and provide a solid evidence base for developing targeted fitness assessment tools and training protocols. Such tools are intended to enhance officers' operational readiness, safety, and long-term health outcomes by catering to the unique demands of their roles, whether in routine patrol settings or high-stakes tactical situations.

2. Materials and Methods

2.1. Search Procedures

Key literature databases were systematically searched using specific keywords relevant to the topic to identify and obtain relevant original research for a literature review. The databases searched included PubMed (https://pubmed.ncbi.nlm.nih.gov/?term=Police+AND+Physical+tasks&sort=date (accessed on 6 February 2024), ScienceDirect (https://www.sciencedirect.com/search?qs=Police%20AND%20occupational%20physical%20ability&years=2016,2017,2018,2019,2020,2021&lastSelectedFacet=years (accessed on 6 February 2024), and the ISCPSI (Higher Institute of Police Sciences and Internal Security, Portugal) common repository (https://comum.rcaap.pt/handle/10400.26/6300 (accessed on 6 February 2024). These databases were selected based on the presence of a large number of high-quality peer-reviewed articles and the representation of journals relevant to

the subject of the review. The final search terms and filters applied to the databases are summarised in Table 1.

Table 1. Databases and relevant search terms.

Databases	Search Terms	Filters	Results
PubMed	"Police" OR "Law enforcement" AND "physical tasks" OR "occupational physical ability"	Sort by Best Match	178
ScienceDirect	"Police" AND "occupational physical ability"	Sort by Relevance	1946
ISCPSI—Higher Institute of Police Sciences and Internal Security (Portugal)	Dissertations Scientific Activity Final Research Papers—Police Command and Direction Course Final Research Papers—Police Direction and Strategy Course	Sort by All	736

Filters reflecting study eligibility criteria were applied in each database, when available, to improve the relevance of the search results. Study eligibility criteria were applied manually by screening study titles and abstracts in the ISCPSI database where these filters were not available or only partially available. The eligibility criteria were used for the full text of identified articles included during title and abstract screening to select a final set of eligible articles for inclusion in this review. The searching, screening, and selecting of results were documented in a PRISMA flowchart (Figure 1) [13]. The inclusion criteria used were a law enforcement population, measures of physical fitness, and measures of occupational physical performance. Exclusion criteria were studies that were older than 15 years, studies that used only body composition as a measure of fitness, studies that involved the development of an instrument, studies that assessed only the effects of carrying a load, studies that used only screening instruments, and validity and reliability studies. Duplicates were removed after the collection of all studies.

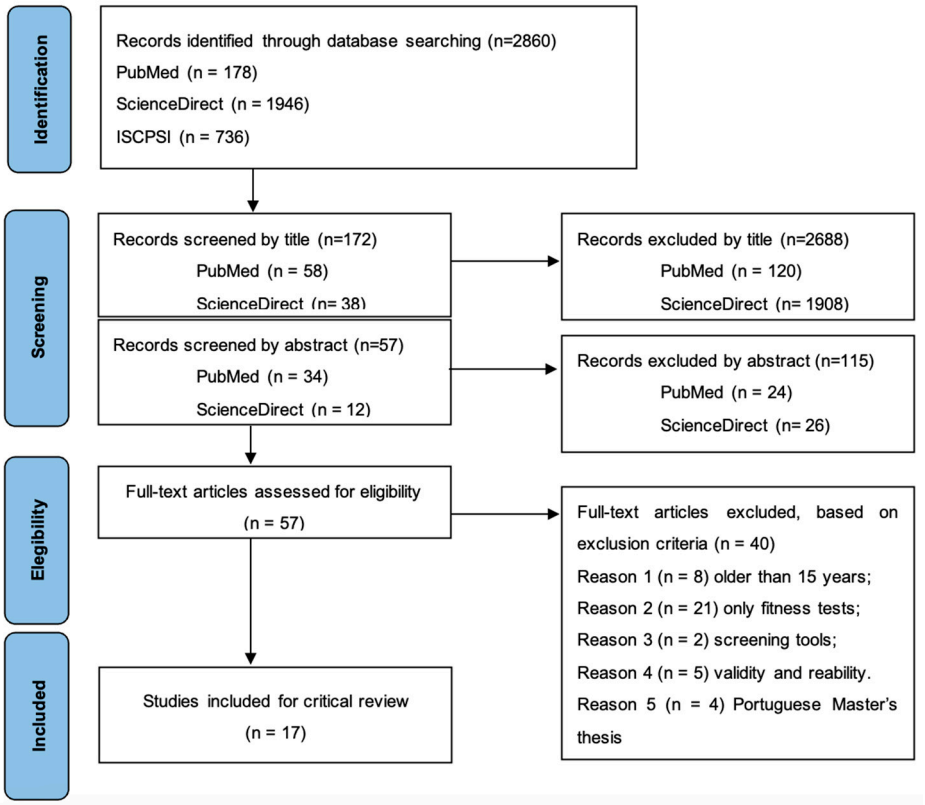

Figure 1. PRISMA diagram detailing the search procedures.

2.2. Critical Appraisal

The CASP (Critical Appraisal Skills and Programs, 2018) is a checklist of ten questions to assess the study's methodological quality. The following responses are given for each question: "yes", "can't say", or "no". Questions 6 and 7 are short-answer questions, which were left blank due to the subjective nature of these questions [14]. Two authors assessed the methodological quality to avoid bias (Table 2).

Table 2. Quality assessment tools for studies are included in the critical review.

Studies	1	2	3	4	5	8	9	10	Quality Score
Adams et al. 2014 [15]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Beck et al. 2015 [16]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Teixeira et al. 2019 [17]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Frio Marins et al. 2019 [18]	yes	yes	yes	yes	yes	no	yes	yes	07/08
Canetti et al. 2020 [19]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
van der Weyden et al. 2021 [20]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Robinson et al. 2023 [21]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Dicks et al. 2023 [22]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Lockie et al. 2018 [23]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Lockie et al. 2019 [24]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Lockie et al. 2020 [25]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Lockie et al. 2020 [26]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Lockie et al. 2021 [27]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Martinez et al. 2022 [28]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Dawes et al. 2022 [29]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Kukić et al. 2022 [30]	yes	yes	yes	yes	yes	yes	yes	yes	08/08
Lockie et al. 2023 [31]	yes	yes	yes	yes	yes	yes	yes	yes	08/08

Legend: Questions 1–5: Are the results of the study valid? (Section A); Questions 8–10: Will the results help locally? (Section C).

2.3. Data Extraction

Following a critical analysis of all articles, the following information was obtained: authors and year of publication; study population; measures (physical fitness testing); measures (occupational, physical skills); main findings; general findings. The results of the most internationally used biomotor skills are presented in Table 3.

Table 3. Data extraction table including the studies that were included in the critical review.

Author/Year of Publication	Population	Measures Physical Fitness	Measures Physical Occupational Abilities	Results	Main Conclusions
Panel A—Incumbent Officers					
Adams et al. 2014 [15]	n = 45 males n = 5 females Age: 41 years Highland Park Department of Public Safety (USA)	- Illinois agility test; - Push-ups; - Sit and reach; - Sit-ups	Tests performed in athletic apparel. Timed OPAT: - Stair climbing; - Ceiling breach; - Forcible entry; - Perpetrator takedown. Completed in athletic apparel.	✓All employees are required to exercise regularly while on duty and to undergo quarterly physical fitness tests. ✓Offers a score-based financial incentive for those who pass the test on the first attempt. ✓The department helps employees prepare for tests.	(1) The new physical fitness test and scoring system has been incorporated into the department's policies and procedures as part of the town's overall employee fitness program.
Beck et al. 2015 [16]	n = 16 males Age: 33.1 ± 8.7 years University Campus Law enforcement officers (USA)	- Sit and reach - Agility—change in direction test; - Bench press; - Leg press; - Handgrip; - Vertical jump; - Sit-ups; - Push-ups; - VO_{2max} treadmill test.	Tests performed in full tactical gear. Timed OPAT: - Stair ascent; - Building entry (s); - Stair ascent/descent (s); - 159 m run (s); - Barrier manoeuvre (s); - Rescue/arrest (s); - Sprint (s); - Completed in PPE.	✓Bivariate correlation coefficients between OPAT times and physical fitness characteristics: - After controlling for age, OPAT time was correlated with agility and aerobic endurance ($p < 0.05$). - Agility with stair ascent, stair ascent/descent and with sprint time ($p < 0.05$). - Relative VO_{2peak} with building entry and 159 m run ($p < 0.05$) and stair ascent/descent ($p < 0.01$). - Push-ups with building entry ($p < 0.05$). - Sit-ups with stair ascent/descent and 159 m run ($p < 0.05$).	(1) Maintaining adequate levels of physical fitness is important to job performance, especially across the career span. (2) Exercise programs and fitness assessments for campus LEOs should address the physical fitness components identified in this study that are relevant for their occupational demands.

Table 3. *Cont.*

Author/Year of Publication	Population	Measures Physical Fitness	Measures Physical Occupational Abilities	Results	Main Conclusions
Teixeira et al. 2019 [17]	n = 97 males Age: categories (20–29, 30–39, 40–49, and >49 years) Police Officers (Portugal)	- Handgrip; - Vertical jump; - Push-ups; - Sit-ups; - Horizontal jump; - 1RM supine; - Running-based anaerobic Sprint test; - VO_{2max} treadmill test.	Tests performed in athletic apparel and full tactical gear. (1) Physical fitness circuit for police function (CAFP): - Simulates a chase/displacement to the scene at 328 m; - Changes in direction; - Obstacles you have to go under and over; - Stair ascent/descent; - Cross balance on a bench; - Walk up and touch a mark at a height of 3.2 m; - Turn over a pedestal 1.5 m high; - Perform 4 controlled falls. (2) Event resolution element: - Spin a 65 kg tire four times; - Lift and carry a 25 kg bag a distance of 5 m, walk around a cone and carry it another 5 m back to the starting point; - Push a sled with a total weight of 45 kg over a distance of 10 m and then pull it 10 m to the starting point; - Transport/pull a 48 kg manikin (victim) over a distance of 7.5 m in a straight line, walk around a cone and return until the victim is deposited at the starting point.	✓Significant differences between the age groups concerning the fitness test battery ($p < 0.01$) and the CAFP variables; significant differences are highlighted between the age groups concerning time (T1, T2, and TT), HR1, HRFinal ($p < 0.01$), and La5 min ($p < 0.05$). ✓A strong correlation between all variables in the fitness test battery and the times obtained in the CAFP ($p < 0.05$).	(1) The CAFP test is reliable and valid and therefore can be used to monitor incumbent police officers' physical fitness for duty. (2) Able to predict their performance in general physical fitness tests.
Frio Marins et al. 2019 [18]	n = 13 males Age: 36.8 ± 3.7 years Federal Highway Police Officers (Brazil)	- VO_{2max} treadmill test; - Biering Sorensen test—Assessing back muscle endurance by holding a horizontal prone position; - SJ; - CMJ; - SLJ; - Pull-ups; - Illinois agility test; - Fletcher test—Assesses anaerobic power through rapid, consecutive horizontal jumps, measuring distance covered against time.	Tests performed in athletic apparel and full tactical gear. OPAT: - 30 m sprint; - Barricade manoeuvre; - Vertical jump; - Horizontal jump; - Rescue—Evaluates strength and endurance through the task of quickly dragging a weight (simulating a victim) over a specified distance; - Cone weave (agility); - Vehicle push—Tests physical strength and endurance by requiring the participant to push a vehicle for a set distance or duration.	✓Correlation coefficients between the time in the OPAT and the physical fitness, without the use of personal protection equipment: - OPAT with standing long jump ($p < 0.05$) and with agility ($p < 0.01$). ✓Correlation coefficients between the time in the OPAT and the physical fitness, with the use of personal protection equipment: - OPAT with squat jump, countermovement jump, agility ($p < 0.05$), and with relative and absolute VO_{2max} ($p < 0.01$).	(1) Different conditions of load carriage have distinct occupational performance predictors. (2) Considering load carriage, physical exercise programs can be aimed at improving police occupational performance. (3) Tests of these physical capacities should be incorporated into physical conditioning batteries. (4) Police officers and specialists should create exercise programs to improve and maintain health, well-being, and physical fitness, considering the physical capabilities of a greater impact on occupational performance, in addition to the load condition used in their work shifts.
Canetti et al. 2020 [19]	n = 106 (n = 101 males; n = 5 females) Age: Males—42.1 ± 7.0 years Females—42.0 ± 7.8 years Law Enforcement Officers (USA)	- 20 m sprint; - 20 m splits; - 20 m MSFT.	- 1.22 m fence jump; - 8.5 m BD; - "Get-up" from a supine position to a fighting stance.	✓Significant positive correlation between sprint scores and performance in occupational tasks. ✓Anaerobic tests' scores predicted about 40% of the performance in the occupational tasks analysed. ✓The MSFT had a small, albeit significant negative correlation with the tasks.	(1) High levels of metabolic fitness correlated with faster performance in police occupational tasks, especially those of an anaerobic nature. (2) Anaerobic fitness conditioning, alongside aerobic fitness conditioning, could be crucial for optimal performance in physically demanding tasks required of police officers.
van der Weyden et al. 2021 [20]	n = 14 males Age: 35.68 ± 5.82 years SWAT operators (USA)	SWAT operators readiness test (SORT): - Six-point weighted lunge; - Loaded push-up; - Isometric pull-up hold; - Loaded squat; - Sled drag; - Yo-yo intermittent recovery test Level 1; - Cooper's test.	Tests performed in athletic apparel. SWAT obstacle course: - Timed run across a 250 m distance; - Foot pursuit with a 25 m sprint; - Climbing into a 2 m high window; - Crawling under a fence; - 25 m serpentine run; - 20 m BD (2 times, 40 m); - 25 m sprint.	✓Pearson correlation coefficient values between SORT events: - Yo-yo was correlated with lunge, push-ups, pull-ups, and squat ($p < 0.01$); - Cooper's test scores were strongly correlated with the obstacle course ($p = 0.003$ and $p < 0.001$). - Obstacle course was associated with yo-yo, lunges, squats, and sled drag ($r = -0.790$, -0.730, -0.766, and 0.802, respectively).	(1) The SORT battery could be used as a valid and reliable testing measure in SWAT populations to assess occupationally specific fitness components. (2) The SORT was strongly correlated with performance on a criterion measure (SWAT obstacle course) and assesses fitness components that typical law enforcement fitness tests fail to measure. (3) SWAT operators have additional physical demands compared to law enforcement officers, and a fitness test that incorporates a load carriage component is of utmost importance.

Table 3. *Cont.*

Author/Year of Publication	Population	Measures Physical Fitness	Measures Physical Occupational Abilities	Results	Main Conclusions
Robinson et al. 2023 [21]	n = 8 males Age: 39.71 ± 3.09 years Specialist police officers (Australia)	- Heart rate; - Movement speed.	Multistorey training scenario: specialist police officers equipped with full personal protective gear, conducted a high-intensity operation within a multistorey building. The scenario involved navigating through complex environments, including closed rooms and staircases, to address simulated active shooter threats.	✓Officers exhibited an average heart rate of 165 bpm (89% of age-predicted heart rate maximum) with significant portions of the scenario performed at high intensity. ✓Movement speed predominantly ranged between 3 and 6.99 km/h, with some instances of faster speeds.	(1) The findings suggest that specialist police officers experience high-intensity physiological demands during active shooter scenarios. (2) The study emphasizes the importance of specific strength and conditioning programs to prepare officers for the physical demands of such high-risk situations.
Dicks et al. 2023 [22]	n = 30 (n = 25 males, n = 5 females) Age: 33.9 ± 8.3 years Males—34.4 ± 8.8 years Females—31.4 ± 5.2 years Incumbent police officers (USA)	- Handgrip strength; - Estimated maximal oxygen consumption (VO_{2max}); - Physical activity levels through self-reported surveys.	Physical readiness assessment: - Stair climb simulator; - Jump obstacle; - Crawl obstacle; - Barrier jump; - Wall vault; - Mobility run; - Push–pull machine (simulate the arrest and control of a non-compliant or resistant subject); - Front and back falls to the floor; - Simulating being knocked down and recovering to their feet; - BD for 15 m.	✓Lower body fat percentage and higher VO_{2max} levels were associated with better assessment outcomes. ✓The study found that police officers' body composition and aerobic fitness were key factors influencing their physical readiness assessment performances. ✓Body fat percentage and estimated VO_{2max} were significant predictors of PRA performance, explaining a substantial portion of the variance in PRA completion times.	(1) The study emphasizes the importance of maintaining a lower body fat percentage and higher aerobic fitness for improving police officers' performance on physical readiness assessments. (2) It highlights the need for law enforcement wellness and fitness initiatives to focus on cardiovascular fitness and physical activity to ensure optimal performance in policing duties.
Panel B—Recruits/Cadets					
Lockie et al. 2018 [23]	n = 219 males n = 34 females Age: 26.69 ± 5.26 years Law enforcement recruits (USA)	Specific fitness test battery (PT500): - Push-ups; - Sit-ups; - Mountain climbers in 120 s; - Pull-ups; - 201 m and 2.4 km runs.	Tests performed in athletic apparel. Work sample test battery (WSTB): - 99OC; - BD with a 165-pound dummy; - 6-foot CLF; - SW; - 500R.	✓Relationships between the PT500 and WSTB: - Push-up with 500R ($p < 0.05$); - Sit-ups with 99OC, CLF and 500R ($p < 0.05$); - Mountain climbers with SW and 500R ($p < 0.05$); - Pull-ups with 99OC, CLF, SW, and 500R ($p < 0.05$); - 201 m run with 99OC and 500R ($p < 0.05$); - 2.4 km run with 99OC, CLF, SW, and 500R ($p < 0.05$).	(1) Muscular endurance and anaerobic and aerobic capacity could influence running tasks such as the 99-yard obstacle course and 500-yard run. (2) Upper-body strength, especially pulling strength, in addition to abdominal strength, may influence climbing tasks (solid wall and chain link fence). (3) Development of these qualities may not just influence the work sample test battery, but job-specific task performance as well. (4) Law enforcement academy should ensure their recruits have the requisite muscular endurance, anaerobic capacity, and aerobic capacity to successfully complete the work sample test battery.
Lockie et al. 2019 [24]	n = 333 males n = 68 females Age: 27.30 ± 5.92 years Law enforcement officer recruits California (graduated group (GRAD) and separated (SEPPR, SEPFI, and SEPAS) from academy training)	- Push-ups; - Sit-ups; - Vertical jump; - Medicine ball throw; - 20 m MSFT.	Tests performed in athletic apparel. - 75PR.	- The GRAD group was significantly younger than the SEPAS ($p < 0.01$) group. - In 75PR, the GRAD group was significantly faster than the SEPFI ($p = 0.02$) group. - The GRAD group also completed significantly more MSFT shuttles than the SEPPR and SEPFI groups (both $p = 0.01$). - There were no significant between-group differences for height, body mass, push-ups, sit-ups, VJ, or MBT.	(1) Influenced by time commitments external to the academy for older recruits, or differences in fitness levels when compared to their younger counterparts which could influence recovery from academy stress. (2) Law enforcement academy training should consider the total training load they impose during the academy to ensure it is not beyond the physical capabilities of some recruits, as this could contribute to injuries.
Lockie et al. 2020 [25]	n = 526 (n = 442 males, n = 84 females) Recruits, older applicant test battery n = 58 (n = 45 males, n = 13 females) Age: 27.31 ± 6.19 years Recruits, newer applicant test battery USA-based Law Enforcement Agency (USA)	- Push-ups; - Sit-ups; - Vertical jump; - Medicine ball throw; - 20 m MSFT.	Tests performed in athletic apparel. - 75PR.	- There were no significant between-group differences in age, height, body mass, or any of the fitness tests. - Newer applicant test battery female recruits completed 13% fewer MSFT shuttles than the older applicant test battery group, which was significant ($p = 0.007$) and had a moderate effect ($d = 0.62$).	(1) There were limited fitness differences between classes hired under older and newer applicant test batteries from one agency. (2) Females in the recruit class hired under the newer applicant test battery exhibited a lower aerobic fitness measured by the multistage fitness test. This could influence their ability to graduate from the academy. (3) Training staff should ensure that female recruits lacking in a specific physical quality receive appropriate training to develop shortcomings that could influence their ability to graduate from the academy.

Table 3. *Cont.*

Author/Year of Publication	Population	Measures Physical Fitness	Measures Physical Occupational Abilities	Results	Main Conclusions
Lockie et al. 2020 [26]	n = 28 males n = 6 females Age = 30.03 ± 5.00 years Deputy Sheriffs in California (USA)	-	Tests performed in athletic apparel. - 99OC; - 165-pound BD; - 6-foot CLF; - 500R.	✓A positive percentage change indicates deputy sheriffs were slower in the WSTB task during patrol school. ✓When considering all deputy sheriffs combined: - the 99OC (small effect), CLF (large effect), SW (large effect), and 500R (moderate effect) all performed significantly slower, while the BD was faster (moderate effect) ($p < 0.05$).	(1) Job-specific fitness of deputy sheriffs as measured by the work sample test battery tended to decline from academy to patrol. (2) Deputy sheriffs be provided access to some form of physical conditioning so they can limit any losses in job-specific fitness and allow officers to better maintain the physical ability and fitness required to perform tasks that are necessary for public safety.
Lockie et al. 2021 [27]	n = 308 (n = 259 males, n = 49 females) Age: 26.29 ± 4.63 years California recruits (USA)	Agency-specific fitness test battery (PT500): - Push-ups; - Sit-ups; - Mountain climbers; - Pull-ups; - 201 m and 2.4 km run; - 20 m MSFT.	Tests performed in athletic apparel. Validated physical ability test + (VPAT+): - CMJ; - 2 kg MBT; - 75PR; Work sample test battery (WSTB): - 99OC; - BD; - Six-foot CLF; - Six-foot SW; - 500R.	✓Relationships between the PT500 and VPAT +, with the WSTB: - Push-up with 99OC and 500R ($p < 0.05$); - Sit-ups with 99OC, SW, and 500r ($p < 0.05$); - Mountain climbers with 99OC and 500R ($p < 0.05$); - Pull-ups with 99OC, CLF, SW, and 500R ($p < 0.05$); - 201 m run with 99OC, CLF, SW, and 500R ($p < 0.05$); - 2.4 km run with 99OC and 500R ($p < 0.05$); - VJ with 99OC, CLF, SW, and 500R ($p < 0.05$); - 75PR with 99OC, BD, CLF, SW, and 500R ($p < 0.05$); - MBT with 99OC and CLF ($p < 0.05$); - MSFT with 99OC, CLF, SW, and 500R ($p < 0.05$)	(1) Specific relationships between the PT500 and novel VPAT + with job-specific performance measured by the WSTB were identified. (2) Muscular endurance and anaerobic and aerobic capacity could influence running tasks such as the 99-yard obstacle course and 500-yard run. (3) Specific lower-body power and 75-yard pursuit run is a change in direction training important for a task such as a foot pursuit. (4) Upper-body and abdominal strength, in addition to upper- and lower-body power, may influence climbing tasks such as the chain link fence and solid wall. (5) The development of upper- and lower-body power and 75-yard pursuit run using a change in direction speed, in addition to the more traditional qualities of muscular endurance and aerobic capacity, could aid in improving the job-specific task performance of law enforcement recruits.
Martinez et al. 2022 [28]	n = 63 (n = 54 males, n = 9 females) Age: Control group (CG)—27.2 ± 5.1 years High Performance (HP)—28.4 ± 7.7 years Police cadets (USA)	- Sit-ups; - Push-ups; - 1.5-mile run; - 1-repetition maximum bench press; - 300 m run.	OPAT: - Running and agility; - Obstacle course (long jump, scaling and descending barriers, and a low crawl under an obstacle); - Ground apprehension simulation (lateral rolls with a weighted bag and push-ups); - Stair climb simulation; - BD.	✓Both groups showed significant improvements in all fitness outcomes except the OPAT from entrance to exit tests. ✓The HP group experienced greater improvements in push-up performance compared to the SC group. ✓OPAT time decreased in both groups from the entrance to the midpoint but increased from baseline to exit.	(1) The implementation of autoregulatory progressive resistance exercise and high intensity interval training methodologies within a cadet population is feasible and produces similar improvements in cadet fitness and occupational performance at a lower internal load.
Dawes et al. 2022 [29]	n = 813 males Age = 27.41 ± 5.92 years n = 372 female Age = 27.01 ± 6.45 years Police trainees (New Zealand)		400 m obstacle course: - Trailer push; - Wheel assembly carry; - 200 m run; - Balance beam; - 1.8 m long jump; - 1 m vault; - 30 m agility run; - Window climb and wall vault; - 75 kg BD; - Wire fence climb.	✓Significant differences were observed between sexes for all anthropometric measures and physical competency test time, with males generally performing better. ✓Younger recruits tended to perform better than older recruits across both genders.	(1) The study highlighted the differences in physical conditioning requirements by age and sex among New Zealand police trainees, suggesting the need for tailored physical conditioning strategies.
Kukić et al. 2022 [30]	n = 63 (n= 39 males; n = 24 females) Age: Males—21.71 ± 0.82 years Females—21.79 ± 0.93 years Police students from the University of Criminal Investigation and Police Studies (Serbia)	Performance under one load condition—unloaded: - Acceleration over 10 m; - Illinois agility test; - 300-yard shuttle run test.	Performance under three load conditions—with a 5 kg load (standard police duty equipment), and with a 10 kg load (loaded vest): - Acceleration over 10 m; - Illinois agility test; - 300-yard shuttle run test.	✓The study found that both 5 kg and 10 kg loads significantly impaired performance in all tests. ✓Male students performed significantly better than female students under all conditions, but the negative impact of load was greater on female students.	(1) Occupational load, even as light as 5 kg, significantly reduces physical performance among police students, with heavier loads exacerbating the effect. (2) Training programs for police officers should consider the impact of load and include strength, power, and anaerobic endurance training to mitigate the negative effects.

Table 3. *Cont.*

Author/Year of Publication	Population	Measures Physical Fitness	Measures Physical Occupational Abilities	Results	Main Conclusions
Lockie et al. 2023 [31]	n= 392 (n = 257 males, n = 135 females) Age: 27.47 ± 6.28 years Males- 27.42 ± 5.84 years Females—27.57 ± 7.03 years) Trainees in Police Force (New Zealand)	Physical appraisal test (PAT): - Push-ups; - 2.4-km run; - VJ; - Grip strength.	Physical competency test (PCT): - 10 m trailer push; - 10 m wheel assembly carry; - 200 m run; - Balance beam walk (5 m long and 1 m high); - 1.8 m long jump; - 30 m agility run; - 1 m high climb through a window; - 1.9 m solid wall climb over; - 7.5 m BD; - 2.2 m wire fence climb.	✓All PAT measures significantly correlated with PCT performance, with aerobic capacity (2.4 km run) and muscular endurance (push-ups) showing particularly strong relationships. ✓Aerobic capacity had the highest predictive relationship with PCT performance.	(1) The study highlighted the importance of aerobic capacity, muscular endurance, strength, and power for successful performance in police occupational tasks. (2) These attributes should be developed in police trainees prior to academy training.

Legend: OPAT—occupational physical ability test; SJ—squat jump; CMJ—countermovement jump; SLJ—Standing long jump; 99OC—99 yard obstacle course; BD—body drag; CFL—chain link fence; SW—solid wall climb; 500R—500 yard run; 75PR—75 yard pursuit run; MSFT—multistage fitness test; MBT—medicine ball throw.

3. Results

A total of 2420 studies were identified through the initial search of three databases. After the removal of duplicates and review by title and abstract, full-text versions of 57 studies were collated for review. These studies were then evaluated against the inclusion and exclusion criteria, after which 17 studies remained for critical review (Table 2). A summary of screening, selection processes, and literature search results can be found in the PRISMA flow diagram (Figure 1) [13].

All studies included LEOs. Twelve studies examined male and female participants [15,19,22–31], whereas the remaining five included only male participants [16–18,20,21]. Table 4 displays the frequency of significant biomotor ability correlates to occupational tasks among these studies. The frequency calculations are based on the percentage of studies demonstrating significant correlations, providing a quantitative overview of how biomotor abilities impact occupational tasks across diverse LEO populations. The following classifications were used to assess the strength of the correlations: trivial (r = 0–0.1), weak (r = 0.10–0.39), moderate (r = 0.40–0.69), strong (r = 0.70–0.89), and very strong (r = 0.90–1.0) [32].

Table 4. Frequency of significant correlations between each biomotor ability and occupational tasks identified in the selected literature.

Biomotor Ability	Occupational Task	Frequency (%)	References
Aerobic capacity—Absolute (L/min)	▪ 99-yard Obstacle Course ▪ 500-yard Run	18%	[16,18,19,30,31]
Aerobic capacity (mL/kg/min)	▪ 99-yard Obstacle Course ▪ 500-yard Run	29%	[16,18,20,28,30]
Anaerobic capacity	▪ 75-foot Pursuit Run	12%	[17–19,30]
Muscular endurance	▪ 99-yard Obstacle Course ▪ Body Drag	65%	[15–31]
Muscular strength	▪ Body Drag ▪ Solid Wall Climb ▪ Chain Link Fence	41%	[16–19,22,23,28,29,31]
Power	▪ Body Drag ▪ Solid Wall Climb ▪ Chain Link Fence	47%	[15–18,22–25,27–31]
Agility	▪ 99-yard Obstacle Course ▪ 500-yard Run ▪ 75-foot Pursuit Run ▪ Body Drag ▪ Solid Wall Climb ▪ Chain Link Fence	41%	[15,16,18,19,22,28–31]
Flexibility	▪ Solid Wall Climb ▪ Chain Link Fence	18%	[15,16,19,22,29,31]

Fitness and Occupational Abilities Measures

Regarding the frequency of evaluation, muscular strength was assessed in 9 articles [16–19,22,23,28,29,31], muscular endurance was measured in 17 articles [15–31], and muscular power was measured in 13 articles [15–18,22–25,27–31]. Other fitness measurements included aerobic capacity, assessed in 7 articles [16,18–20,28,30,31] and anaerobic capacity in 4 articles [16,18,19,30]. Agility was assessed in 9 [15,16,18,19,22,28–31] articles, and the least commonly reported fitness measure was flexibility, which was assessed in 6 articles [15,16,19,22,29,31].

The most common biomotor abilities associated with occupational task performance included relative aerobic capacity, muscular strength, and agility (Table 3). Secondarily, muscular endurance, absolute aerobic capacity, and power were found to be related to occupational task performance. Those studies evaluated anaerobic capacity and flexibility less frequently and unrelated to occupational task performance.

There was considerable variability in the task composition and application of the occupational physical ability assessments. For instance, some studies utilised exercises that simulate occupational tasks like running and pushing objects to simulate foot chases and suspect engagement. Most studies included the victim rescue/body drag [19,22,23,26,29,31] and foot pursuit [19,22,24,25,31]. The 99-yard obstacle course [23,26,27], chain link fence [19,23,26,29,31], solid wall climb [21–23,27–29,31], and 500-yard run [23,26,27] were used less frequently. The application of the test battery also varied between studies, with most studies requiring completion of the occupational physical ability assessment on a separate day from fitness assessments. Ten of the studies completed occupational physical ability and fitness assessments on the same day [17,19,21–26,29,31], whereas the remaining seven studies completed each testing battery on different days [15,16,18,20,27,28,30]. In addition, some physical ability assessments required multiple occupational tasks to be completed continuously, whereas others allowed for recovery between tasks. This could be important for further studies as performing various tasks in succession (especially high-intensity, short-duration tasks) generally correlates with aerobic endurance.

To encapsulate the critical findings of our systematic review and to directly address the aim of identifying key biomotor abilities essential for law enforcement officers' occupational performance, Table 5 below provides a concise summary of these abilities, along with their evaluation frequency, correlation strength, and relevance to specific occupational tasks.

Table 5. Summary of biomotor abilities associated with occupational performance in law enforcement officers.

Biomotor Ability	Frequency of Evaluation	Strength of Correlation	Relevance to Occupational Tasks
Muscular Strength	9 articles	Moderate to Strong	Essential for tasks requiring force and endurance, e.g., body drags, obstacle course.
Muscular Endurance	17 articles	Moderate to Very Strong	Crucial for sustained performance in prolonged activities and emergency response situations.
Muscular Power	13 articles	Weak to Moderate	Important for explosive actions like jumping and sprinting during pursuits or tactical operations.
Aerobic Capacity	7 articles	Moderate to Strong	Vital for overall endurance and performance in foot pursuits and high-intensity tasks over time.
Anaerobic Capacity	4 articles	Weak to Moderate	Relevant for short, intense bursts of activity, particularly in tactical interventions.
Agility	9 articles	Moderate to Strong	Key for maneuverability and quick direction changes in dynamic operational environments.
Flexibility	6 articles	Trivial to Weak	Beneficial for preventing injuries and maintaining mobility, though less directly tied to specific tasks.

4. Discussion

This manuscript aimed to systematically review the literature to identify relevant biomotor abilities associated with the occupational physical ability of law enforcement officers (LEOs). The findings indicated that a multitude of biomotor abilities were found to be associated with occupational performance. This finding is intuitive given that no federal or internationally standardised fitness assessments or occupational physical ability tests exist for LEOs. As such, each study included in the review utilised a different fitness assessment battery and physical ability test. Indeed, it is understandable that different law enforcement agencies may use diverse occupational physical ability tests as the physical demands for a given LEO type (e.g., recruit, incumbent officer, SWAT officer, campus officer) and municipality (rural vs. urban) may vary. Despite this caveat, several themes emerged that provide useful information for practitioners, researchers, and law enforcement agencies. A description of these outcomes is provided below.

Although numerous biomotor abilities were found to have statistically significant correlations to occupational performance, the strengths of the correlations varied greatly. Lockie et al. [23] observed a significant but weak correlation between the PT500 and performance in select occupational tasks, with the strongest correlation found between the 2.4 km run and the 500-yard run ($r = -0.57$). Similarly, Locke et al. [27] experienced similar weak to moderate correlations between most fitness evaluations and occupational tasks ($r = 0.11–0.35$) except moderate to strong correlations between MSFT, the 201 m run, 2.4 km run, and 500-yard run. Becket al. found that agility, aerobic endurance, and muscular endurance were associated with the occupational demands of campus police [16]. The authors in each study concluded that muscular and aerobic endurance are critical biomotor abilities related to law enforcement occupational tasks.

Regarding the importance of anaerobic biomotor abilities in occupational performance, Teixeira et al. [17] found moderate to strong correlations between several fitness tests, particularly strength and power assessments and Portuguese on-duty task evaluation completion times [17]. Overall, the correlations found within these studies support using a broad range of physical fitness assessments to evaluate occupational performance while highlighting the diversity in the physical demands of LEOs. This is logical considering the essential job tasks of LEOs include foot pursuit with potential obstacles, suspect altercation, defensive tactics, and victim rescue scenarios [16,17,19,22,23,27–29,31].

The relationship of these biomotor abilities with PPE demands is crucial for optimising the performance and safety of LEOs in the field. Agility refers to the ability to change direction quickly. This characteristic is critical when chasing a suspect, taking cover when taking gunfire, or closing a distance quickly to neutralise a threat. Research indicates that the ability to accelerate is important, especially under the load carriage conditions imposed by tactical gear [10,19,30].

It is also important to note that biomotor abilities are likely not mutually exclusive and, thus, not independent. For instance, cardiorespiratory fitness is closely linked to muscular endurance, as the muscles require oxygen to perform work over a prolonged period [32]. Indeed, muscular endurance and aerobic capacity have typically been correlated with similar running tasks, such as the 99-yard obstacle course and the 500-yard run [23,27]. Likewise, upper-body strength, such as pulling or abdominal strength, may influence climbing tasks, such as a solid wall and chain-link fence [19,21–23,27–29,31]. Agility, sit-up, upper-body strength, and aerobic capacity were collectively related to overall occupational physical performance tasks [16,19,27–31].

Strength measures have also been associated with task performance and injury risk, and studies suggest that using personal protective equipment decreases LEOs' physical performance on cardiorespiratory fitness tests, strength, power, and speed during changes in direction [18,29,30]. Tests of these physical abilities should be included in conditioning batteries to determine the relationships between physical fitness and occupational performance when using personal protective equipment [18,20,30,32].

Law enforcement agencies should ensure that their recruits have the muscular endurance, anaerobic capacity, and aerobic capacity necessary to complete the work trial test battery [19,23,30].

Fewer studies examined the relationship between flexibility and anaerobic capacity versus occupational physical performance. Despite the lack of evaluation of these biomotor abilities, they may still be relevant to optimising LEO performance and health. For instance, flexibility, unless significantly limited, likely does not impact performance. However, lack of flexibility in some joints may increase lower back pain incidence [33]. This can be especially problematic for officers spending extensive time seated in a patrol car while wearing a duty belt. Indeed, muscular tightness associated with the lower cross syndrome (i.e., tightness of hip flexors and hamstring muscles) may increase lower back pain and symptomology [33]. Although anaerobic capacity was not related to occupational performance, Thomas et al. [9] reported that anaerobic fatigue tolerance was associated with decreased occupational task efficiency due to load carriage in special weapons and tactics officers (SWAT).

Also, age and function are important in differentiating older recruits' assessments, time commitments outside the academy, or differences in fitness levels compared with younger recruits that could influence outcomes and recovery. As individuals age, they tend to lose muscle mass, strength, and cardiovascular fitness [24]. This can make it more difficult for older LEOs to perform tasks that require a high level of physical fitness. Differences in fitness levels compared to their younger counterparts could also affect recovery. Maintaining a moderate to high running intensity, characterised by a specific pace or VO_{2max} levels indicative of aerobic capacity and good aerobic fitness, significantly enhanced the likelihood of successful completion [24]. Age was significantly positively correlated with the overall duration of physical skills and tasks on the job [16,29,33].

Significant phase-specific changes in overall physical performance were observed during the individualised training course, including decreases in body fat percentage, anaerobic capacity, and maximal oxygen uptake. Current performance training during the course improves critical strength and power aspects [34].

Fitness standards and training protocols need to be developed for each law enforcement agency and adapted to each target population. Differences in fitness testing procedures have also been noted, highlighting the need to standardise fitness testing procedures to ensure consistency and enhance the ability to compare results. Developing occupational and health-related fitness standards and associated health and conditioning strategies will help to improve the health and fitness of officers. Health status has an impact on biomotor abilities. Officers who have chronic health conditions such as obesity or diabetes may find it more difficult to perform tasks that require a high level of physical fitness [35].

5. Conclusions

In summary, this study conducted a rigorous analysis of the physical demands and fitness requirements of LEOs across various roles. By synthesising data from 17 worldwide studies, we identified critical areas for improvement in current fitness programs and policy guidelines. Our findings highlight the necessity of tailored fitness strategies to address the unique challenges officers face, ranging from the sedentary aspects of surveillance and administrative duties to the physically demanding nature of tactical operations. The study underscores the importance of maintaining operational readiness and promoting long-term health and well-being among law enforcement personnel. The practical implications of our research advocate for policy reforms and the implementation of diversified training regimens that are scientifically grounded and role-specific. Future research should continue to explore the evolving physical demands of law enforcement work and the most effective training methodologies to meet these challenges. Ultimately, this study contributes to the ongoing dialogue on enhancing the safety, effectiveness, and health of those who serve in law enforcement.

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