**International Journal of Police Science**
ISSN 2771-3377 (online); ISSN 2771-3385 (print)
https://IJPS-Journal.org
**Volume 4, Issue No. 2 (2025)**

International Police Science Association (IPSA)

*Research Article*

# Physical activity of Police Officers during police service

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https://doi.org/10.56331/ijps.v4i2.10937

Submitted: 25 September 2024
Accepted: 2 November 2024
Published: 11 September 2025

**Abstract:**

Modern police work has become increasingly sedentary due to technological advancements and administrative tasks, interspersed with occasional intense physical activity, and this study aims to assess Police officers (POs) usual PAL during police service. This is a cross-sectional study in which 32 POs (age, 26.91±3.66 years) belonging to COMETLIS/PSP participated. ActiGraph model GT3X accelerometers were used to assess PA during police service, and the physical activity level (PAL) classification included the categories: sedentary, light, moderate, vigorous, and moderate to vigorous PA (MVPA). A total of 2584 hours of police activity were considered, corresponding to 323 8-hour shifts, of which 136 were morning shifts, 125 were afternoon shifts, and 62 were night shifts. It was observed that (i) the time spent on sedentary (54.44%), light (15.57%), moderate (8.42%), vigorous (0.83%), and MVPA (9.25%) while performing police work underwent statistically significant differences; and (ii) the day of the week, the shift of duty and time of day had a statistically significant effect on the time spent on sedentary, light, moderate, vigorous and MVPA of police officers in the performance of police duty. Police work is primarily sedentary, with moderate to vigorous PA peaks corresponding to more demanding events. It seems relevant to counteract the excessive sedentary time associated with patrolling for professional and health reasons, as well as for quality of life, and to ensure the ability to act in an emergency scenario to resolve it because even though it represents a small percentage of working time, they are often linked to life-threatening situations. The findings imply that mitigating excessive sedentary time is crucial for professional performance, health, and quality of life, ensuring the ability to respond effectively in emergencies. This underscores the need for policies and structured programs that promote regular physical activity during service, ultimately enhancing occupational health and operational efficiency.

Citation: Franco, Leandro, Santos, Vanessa and Miguel Massuca, Luís. "Physical activity of Police Officers during police service." *International Journal of Police Science* 4, no. 2 (2025). https://doi.org/10.56331/ijps.v4i2.10937

**Keywords:** Police Gender Equality, Equal Opportunity, Equal Treatment, Recruitment Policy,

Promotion Policy, Organizational Performance and Police Command.

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**Keywords:** Law enforcement; MVPA; Police; Sedentary; Tactical populations.

## Introduction

Police officers (POs) play a crucial role in representing legality and the state structure itself, promoting democratic principles, protecting society's interests and contributing to defending and consolidating human dignity.

PO intervention encompasses various types of action, from a purely preventive and dissuasive role to a more reactive and vigorous action. Despite the high demands, rigour, and responsibility inherent in police duties, the nature of POs' activity has been changing in parallel with (i) technological developments and (ii) a decrease in the physical demands required.[1] PO activity has gradually become more associated with administrative tasks[2] and is mainly characterised by sedentary tasks interrupted by occasional periods of intense activity.[3]

Although POs' work is primarily sedentary, the unpredictability of incidents associated with the level of intensity of the activity leads to a permanent need for physical-psychological management on the part of the PO, who has to be prepared to interrupt long periods of stillness with short periods of high physical and mental intensity[4] such as in situations involving shootings, robberies or road accidents.[5] The physical readiness of POs is paramount, as inadequate fitness levels can significantly impact performance during critical incidents.[6]

These characteristics (sedentary lifestyles vs. unpredictable events that require high-intensity energy peaks), together with irregular working hours (i.e. day and night shifts), (i) make the POs profession one of the most demanding and stressful in society[7] and (ii) point to the need for adequate training to develop POs physical fitness and prepare them for the demands of their profession. The chronic stress associated with police work has been linked to higher rates of cardiovascular diseases and mental health issues.[8]

It is currently indisputable that physical activity (PA) is associated with numerous health benefits, such as improved cardiovascular and metabolic health, mood and well-being, and cognitive performance, as well as the prevention of death from any cause and numerous chronic non-communicable diseases (NCDs - cancer, dementia, diabetes, hypertension, etc.).[9] Similarly, sedentary behaviour has been independently associated with adverse health outcomes related to the diseases,[10] and active individuals are generally less likely to suffer from NCDs.[11]

Recent studies have highlighted the impact of physical inactivity among law enforcement officers, linking it to increased risks of cardiovascular and metabolic diseases and decreased performance during critical incidents. Research such as the study by Oliver et al.[12] emphasises the association between job stress and reduced psychological well-being in POs, with

moderate physical activity as a protective factor]. Similarly, Canetti et al.[13] have demonstrated the critical relationship between metabolic fitness and the ability to perform occupational tasks efficiently, underscoring the necessity of aerobic and anaerobic conditioning for optimal performance. Additionally, Marins et al.[14] conducted a systematic review characterising the physical fitness of POs, highlighting the need for structured fitness programs to address deficits in aerobic and anaerobic capacities, as these are crucial for performing physically demanding tasks and ensuring officer safety and effectiveness.

In the specific case of POs, this need for regular PA practice is exacerbated by the sedentary lifestyle associated with the profession itself, implying that even if the recommendations outlined for PA practice are complied with, this may not be enough to mitigate the adverse effects of the police profession.[15] The literature stresses balancing working conditions and the professional's physical fitness to prevent health complaints and minimise physiological overload.[16] Additionally, structured PA programs tailored to the unique needs of POs can enhance job performance and overall health.[17]

Given this premise, it is vital to know the physical demands associated with different PO tasks, as this information can offer relevant advantages for the PO service,[18] mainly when drawing up appropriate training models for developing fundamental competencies for the profession. Furthermore, the physical training of POs is an essential aspect of the daily fulfilment of the vital text of operational action. It is crucial in promoting and strengthening POs' physical and mental health.[19]

Bearing the above in mind, it is essential to increase objective knowledge of police duties. It seems to us that there is a gap in objective studies on the characterisation of police activity, which, together with the lack of actual data on the physical activity level (PAL) in POs activity, makes this topic not only exciting but also extremely useful for optimising the health and performance of POs. By this, this study aims to assess POs' usual PAL during police service.

## Methods

### *Participants*

This cross-sectional study involved the voluntary participation of 32 police officers (POs) (age, 26.91 ± 3.66 years; stature, 1.75 ± 0.06 m; body mass, 76.00 ± 8.03 kg). The sample included POs from the Portuguese Public Security Police (PSP) - Lisbon Metropolitan Command (COMETLIS). Of these POs, nine work in the 2nd Police Division, two work in the 4th Police Division, ten work in the 5th Police Division, nine work in the Loures Police Division, and two

work in the Oeiras Police Division. All participants read and signed an informed consent form, and data collection occurred between December 15, 2023, and April 15, 2024.

*Assessment tools and procedures*

To quantify POs PAL during operational duty, the ActiGraph accelerometer model GT3X (ActiGraph, Pensacola, Florida, USA) was used. The device was initialised, and the recorded data was transferred using Actilife 5.0 software. Data collection was configured to start with 60-second epochs. Participants were thoroughly instructed on the proper use of the accelerometer: it was placed on an elasticated belt and fastened firmly to the wrist for the entire shift. Along with the accelerometer, each participant received a record sheet for entering general characterisation parameters necessary for data processing (age, height, and weight) and recording the day and time corresponding to the shift during which the device was used.

Accelerometers are sophisticated instruments that accurately measure body movements across multiple planes, thus enabling an objective analysis of physical activity in frequency, duration, and intensity based on acceleration signals.[20] The period of use of the accelerometers should correspond to that considered necessary to reflect the habitual pattern of PA, which is influenced by factors such as the nature of the population, the availability of financial and logistical resources and the participant's adherence to the study.[21] The aim was to collect data on the entire cycle of police service completed by each PO, i.e. two nights, two mornings and two afternoons, with each shift corresponding to eight hours of activity. PAL classification encompassed various levels of physical activity intensity — sedentary, light, moderate, vigorous, and moderate to vigorous physical activity (MVPA) — based on the minutes per hour spent at each intensity level. After excluding outliers (n = 429; 14.2%), 2584 hours of police activities were considered, corresponding to 323 eight-hour shifts, of which 136 were morning shifts (08H00 - 16H00), 125-afternoon shifts (16H00 - 24H00), and 62-night shifts (00H00 - 08H00). Table 1 shows the data collected and its distribution regarding the hours worked during each shift and day of the week.

**Table 1:** Data regarding hours (n (%)), shifts (n), and days of the week.

| | Shifts | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Morning (08H00-16H00) | | Afternoon (16H00-24H00) | | Night (24H00-08H00) | | | |
| | hours | shifts | hours | shifts | hours | shifts | hours | shifts |
| Monday | 184 (16.9) | 23 | 200 (20.0) | 25 | 48 (9.7) | 6 | 432 (16.7) | 54 |
| Tuesday | 240 (22.1) | 30 | 200 (20.0) | 25 | 64 (12.9) | 8 | 504 (19.5) | 63 |
| Wednesday | 216 (19.9) | 27 | 344 (34.4) | 43 | 80 (16.1) | 10 | 640 (24.8) | 80 |
| Thursday | 104 (9.6) | 13 | 144 (14.4) | 18 | 40 (8.1) | 5 | 288 (11.1) | 36 |
| Friday | 96 (8.8) | 12 | 72 (7.2) | 9 | 112 (22.6) | 14 | 280 (10.8) | 35 |
| Saturday | 120 (11.0) | 15 | 24 (2.4) | 3 | 88 (17.7) | 11 | 232 (9.0) | 29 |
| Sunday | 128 (11.8) | 16 | 16 (1.6) | 2 | 64 (12.9) | 8 | 208 (8.0) | 26 |
| Subtotal | 1088 (42.1) | 136 | 1000 (38.7) | 125 | 496 (19.2) | 62 | 2584 (100.0) | 323 |

*Statistical analysis*

Among the various measures of descriptive statistics, measures of central tendency (mean, M) and dispersion (standard deviation, SD) were used to characterise the sample. In addition, non-parametric tests were used in the statistical evaluations (due to weaknesses identified in the assumptions for applying parametric tests), i.e.: (i) the Friedman test, followed by multiple comparisons, to assess ($\alpha = 0.05$) whether the significance of the time spent on sedentary, light, moderate, vigorous and MVPA in the performance of PO work is the same; and (ii) the Kruskal-Wallis test, followed by multiple comparisons, to assess ($\alpha = 0.05$) PA during PO work, i.e., to assess whether the day of the week (Monday; Tuesday; Wednesday; Thursday; Friday; Saturday; Sunday), shift (night; morning; afternoon) and time of day (00.00 to 23.00) significantly influenced the time spent (absolute, minutes/hour; relative, %) by PO on sedentary, light, moderate, vigorous or MVPA. The Microsoft Excel (v2013, Microsoft, Redmond, WA, USA) was used to organise the data. Complementarily, statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS Inc., version 28.0, Chicago, IL, USA).

## Results

In general, it was observed that the time spent on sedentary, light, moderate, vigorous and MVPA in the PO work underwent statistically significant changes (absolute and relative, $X_F^2(4) = 5171.716$, $p < 0.001$, n = 2584) (Table 2).

**Table 2:** Time spent (absolute and relative) in sedentary, light, moderate, vigorous and MVPA by police officers in performing their duties.

| | Absolute Physical Activity (minutes/hour) | | | Relative Physical Activity (%) | | |
|---|---|---|---|---|---|---|
| | Mean | SD | *rank* | Mean | SD | *rank* |
| Sedentary | 29.45 | 23.69 | 4.18 | 54.44 | 39.06 | 4.18 |
| Light | 7.37 | 9.80 | 3.54 | 15.57 | 19.67 | 3.54 |
| Moderate | 4.08 | 6.70 | 2.59 | 8.42 | 13.56 | 2.59 |
| Vigorous | 0.44 | 1.17 | 1.77 | 0.83 | 2.22 | 1.77 |
| MVPA | 4.52 | 7.58 | 2.92 | 9.25 | 14.96 | 2.92 |

Key: SD, standard deviation; MVPA, moderate to vigorous physical activity.

It was observed that the day of the week (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday) had a statistically significant effect on the time spent on sedentary, light, moderate, vigorous and MVPA of PO in the performance of police duty (all, $p < 0.001$), with the average PA values being higher on Saturday (moderate, 5.91 minutes/hour and 12.47%; vigorous, 0.72 minutes/hour and 1.39%; MVPA, 6.63 minutes/hour and 13.85%) and Sunday (sedentary, 35.41 minutes/hour and 61.85%; light, 12.03 minutes/hour and 21.38%). The results are shown in Tables 3 and 4.

**Table 3:** Time spent in sedentary, light, moderate, vigorous and MVPA of police officers each day of the week (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday).

| Physical Activity | Day of the week | | | | | | | | | | | | | | Kruskal-Wallis test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Monday (n = 432) | | Tuesday (n = 504) | | Wednesday (n = 640) | | Thursday (n = 288) | | Friday (n = 280) | | Saturday (n = 232) | | Sunday (n = 208) | | | | |
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | KW | df | Sig. |
| Absolute Physical Activity (minutes/hour) | | | | | | | | | | | | | | | | | |
| Sedentary | 33.77 | 23.84 | 30.10 | 23.74 | 33.37 | 25.68 | 15.96 | 18.47 | 22.06 | 21.67 | 29.48 | 20.86 | 35.41 | 19.24 | 174.646 | 6 | *** |
| Light | 8.45 | 11.27 | 6.35 | 8.58 | 4.50 | 8.03 | 6.95 | 9.05 | 8.03 | 10.32 | 11.06 | 10.70 | 12.03 | 10.15 | 172.392 | 6 | *** |
| Moderate | 4.18 | 6.46 | 3.64 | 6.25 | 3.16 | 6.66 | 3.69 | 6.53 | 4.45 | 7.52 | 5.91 | 6.70 | 5.78 | 6.79 | 121.241 | 6 | ** |
| Vigorous | 0.36 | 0.79 | 0.37 | 1.13 | 0.34 | 1.03 | 0.51 | 1.57 | 0.49 | 1.21 | 0.72 | 1.60 | 0.56 | 0.91 | 81.454 | 6 | ** |
| MVPA | 4.54 | 7.08 | 4.01 | 7.09 | 3.50 | 7.51 | 4.20 | 7.55 | 4.93 | 8.55 | 6.63 | 7.79 | 6.33 | 7.57 | 122.989 | 6 | ** |
| Relative Physical Activity (%) | | | | | | | | | | | | | | | | | |
| Sedentary | 58.50 | 39.19 | 56.69 | 39.31 | 60.26 | 41.76 | 37.57 | 35.14 | 44.37 | 38.48 | 52.43 | 34.16 | 61.85 | 30.70 | 130.258 | 6 | ** |
| Light | 16.62 | 21.85 | 14.33 | 18.31 | 9.79 | 16.50 | 20.35 | 24.07 | 16.54 | 19.89 | 19.92 | 17.66 | 21.38 | 17.27 | 147.951 | 6 | ** |
| Moderate | 7.58 | 11.30 | 8.77 | 14.56 | 6.69 | 14.38 | 8.12 | 12.11 | 8.84 | 13.94 | 12.47 | 14.93 | 10.02 | 11.39 | 110.992 | 6 | ** |
| Vigorous | 0.64 | 1.43 | 0.76 | 2.43 | 0.61 | 1.81 | 0.97 | 2.76 | 0.97 | 2.48 | 1.39 | 3.14 | 0.97 | 1.55 | 78.624 | 6 | ** |
| MVPA | 8.22 | 12.37 | 9.53 | 15.95 | 7.30 | 15.63 | 9.09 | 13.67 | 9.80 | 15.79 | 13.85 | 16.49 | 11.00 | 12.70 | 113.252 | 6 | ** |

Key: ***, $p < 0.001$; SD, standard deviation; MVPA, moderate to vigorous physical activity.

**Table 4:** Multiple comparisons of time spent in sedentary, light, moderate, vigorous and MVPA of police officers each day of the week (Monday, 1; Tuesday, 2; Wednesday, 3; Thursday, 4; Friday, 5; Saturday, 6; Sunday, 7).

| | Multiple Comparisons | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-2 | 1-3 | 1-4 | 1-5 | 1-6 | 1-7 | 2-3 | 2-4 | 2-5 | 2-6 | 2-7 | 3-4 | 3-5 | 3-6 | 3-7 | 4-5 | 4-6 | 4-7 | 5-6 | 5-7 | 6-7 |
| Absolute Physical Activity (minutes/hour) | | | | | | | | | | | | | | | | | | | | | |
| Sedentary | | | *** | *** | | | | *** | *** | | | *** | *** | | | * | *** | *** | ** | *** | |
| Light | | *** | | | *** | *** | *** | | | *** | *** | *** | *** | *** | *** | | *** | *** | ** | *** | |
| Moderate | | ** | | | *** | *** | *** | | | *** | *** | ** | *** | *** | *** | | *** | *** | ** | ** | |
| Vigorous | | ** | | | * | ** | | | | *** | *** | | * | *** | *** | | ** | ** | * | * | |
| MVPA | | ** | | | *** | *** | *** | | | *** | *** | ** | *** | *** | *** | | *** | *** | ** | ** | |
| Relative Physical Activity (%) | | | | | | | | | | | | | | | | | | | | | |
| Sedentary | | | *** | *** | | | | *** | *** | | | *** | *** | ** | | | *** | *** | | *** | |
| Light | | *** | | | ** | *** | *** | | | *** | *** | *** | *** | *** | *** | | | | * | *** | |
| Moderate | | ** | | | *** | *** | *** | | | *** | ** | *** | *** | *** | *** | | ** | * | ** | * | |
| Vigorous | | ** | | | ** | ** | | | | *** | *** | | * | *** | *** | | ** | ** | * | * | |
| MVPA | | ** | | | *** | *** | *** | | | *** | ** | *** | *** | *** | *** | | ** | * | ** | * | |

Key: *, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$; MVPA, moderate to vigorous physical activity.

It was observed that the shift of duty (night, morning and afternoon) had a statistically significant effect on the time spent in sedentary (absolute and relative, $p < 0.001$), light (absolute and relative, $p < 0.001$), moderate (absolute, $p = 0.004$; relative, $p = 0.013$), vigorous (absolute, $p = 0.023$; relative, $p = 0.030$) and MVPA (absolute, $p = 0.004$; relative, $p = 0.016$) of POs performing their duties, with the following being observed in the afternoon shift: (i) higher average values for sedentary (32.46 minutes/hour; 58.08%) and vigorous (0.46 minutes/hour; 0.86%) activities; and (ii) lower average values for light (6.99 minutes/hour; 14.22%) and moderate (4.00 minutes/hour; 7.85%) activities. The results are shown in Table 5.

**Table 5:** Time spent in sedentary, light, moderate, vigorous and MVPA of police officers on duty shifts (night, 00H00-08H00; morning, 08H00-16H00; afternoon, 16H00-24H00).

| | Shifts | | | | | | Kruskal-Wallis test | | | Multiple Comparisons | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Night (n = 496) (1) | | Morning (n = 1088) (2) | | Afternoon (n = 1000) (3) | | | | | | | |
| | Mean | SD | Mean | SD | Mean | SD | KW | df | Sig. | 1-2 | 1-3 | 2-3 |
| Absolute Physical Activity (minutes/hour) | | | | | | | | | | | | |
| Sedentary | 32.29 | 22.19 | 25.38 | 23.53 | 32.46 | 23.95 | 54.280 | 2 | *** | *** | | *** |
| Light | 8.89 | 9.99 | 7.03 | 9.87 | 6.99 | 9.57 | 27.551 | 2 | *** | *** | *** | |
| Moderate | 4.31 | 6.74 | 4.05 | 6.64 | 4.00 | 6.75 | 11.295 | 2 | ** | ** | ** | |
| Vigorous | 0.42 | 1.02 | 0.42 | 1.01 | 0.46 | 1.37 | 7.548 | 2 | * | * | | |
| MVPA | 4.73 | 7.58 | 4.47 | 7.47 | 4.46 | 7.70 | 11.084 | 2 | ** | ** | | |
| Relative Physical Activity (%) | | | | | | | | | | | | |
| Sedentary | 58.00 | 36.10 | 49.48 | 39.88 | 58.08 | 39.00 | 31.716 | 2 | *** | ** | | *** |
| Light | 16.63 | 17.59 | 16.33 | 21.17 | 14.22 | 18.88 | 17.658 | 2 | *** | * | *** | |
| Moderate | 8.50 | 13.00 | 8.92 | 13.87 | 7.85 | 13.49 | 8.670 | 2 | * | | * | |
| Vigorous | 0.74 | 1.74 | 0.83 | 2.16 | 0.86 | 2.48 | 6.992 | 2 | * | * | | |
| MVPA | 9.23 | 14.25 | 9.75 | 15.27 | 8.70 | 14.96 | 8.251 | 2 | * | | * | |

Key: *, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$; SD, standard deviation; MVPA, moderate to vigorous physical activity.

It was observed that the time of day (00.00 to 23.00) had a statistically significant effect on the time spent (absolute and relative) on sedentary, light, moderate and MVPA (all, $p < 0.001$) of POs performing their police duties, with the highest average values occurring during night shift hours. The results are shown in Table 6 (absolute) and Table 7 (relative).

**Table 6:** Absolute time spent (minutes/hour) in sedentary, light, moderate, vigorous and MVPA by police officers at each time of day (00.00 to 23.00).

| Service | Shifts | Sedentary | | Light | | Moderate | | Vigorous | | MVPA | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hours | (n) | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| 00H00 | 62 | 30.14 | 19.96 | 11.49 | 9.88 | 6.28 | 7.99 | 0.50 | 0.95 | 6.78 | 8.81 |
| 01H00 | 62 | 26.63 | 22.12 | 11.77 | 12.22 | 5.70 | 8.41 | 0.76 | 1.87 | 6.46 | 9.95 |
| 02H00 | 62 | 28.76 | 21.75 | 11.46 | 11.17 | 6.17 | 9.07 | 0.66 | 1.27 | 6.83 | 10.22 |
| 03H00 | 62 | 31.29 | 21.29 | 10.53 | 10.37 | 5.46 | 7.03 | 0.44 | 0.77 | 5.90 | 7.58 |
| 04H00 | 62 | 34.77 | 22.43 | 8.68 | 9.79 | 3.15 | 4.88 | 0.26 | 0.59 | 3.41 | 5.33 |
| 05H00 | 62 | 37.61 | 22.86 | 6.27 | 7.83 | 2.65 | 4.65 | 0.19 | 0.56 | 2.84 | 5.13 |
| 06H00 | 62 | 38.64 | 23.51 | 5.78 | 8.57 | 2.03 | 3.89 | 0.21 | 0.66 | 2.24 | 4.47 |
| 07H00 | 62 | 30.46 | 21.74 | 5.17 | 6.61 | 3.03 | 4.46 | 0.32 | 0.65 | 3.35 | 5.06 |
| 08H00 | 136 | 27.30 | 22.67 | 6.72 | 8.66 | 4.15 | 6.17 | 0.31 | 0.75 | 4.46 | 6.78 |
| 09H00 | 136 | 24.98 | 23.08 | 7.42 | 10.07 | 4.76 | 7.18 | 0.48 | 1.07 | 5.24 | 8.07 |
| 10H00 | 136 | 23.54 | 24.04 | 6.98 | 10.21 | 4.16 | 7.58 | 0.44 | 0.99 | 4.60 | 8.50 |
| 11H00 | 136 | 24.73 | 23.19 | 7.73 | 10.64 | 4.68 | 7.32 | 0.44 | 0.90 | 5.12 | 8.02 |
| 12H00 | 136 | 24.79 | 23.89 | 7.40 | 10.40 | 4.30 | 7.81 | 0.45 | 1.17 | 4.75 | 8.85 |
| 13H00 | 136 | 26.18 | 23.91 | 7.61 | 10.44 | 3.96 | 5.94 | 0.38 | 0.97 | 4.34 | 6.65 |
| 14H00 | 136 | 26.37 | 23.53 | 7.47 | 10.82 | 3.55 | 5.86 | 0.42 | 1.08 | 3.97 | 6.68 |
| 15H00 | 136 | 25.16 | 24.26 | 4.90 | 7.02 | 2.83 | 4.65 | 0.42 | 1.10 | 3.26 | 5.58 |
| 16H00 | 125 | 31.25 | 24.42 | 7.03 | 10.31 | 4.74 | 8.30 | 0.54 | 1.49 | 5.28 | 9.34 |
| 17H00 | 125 | 31.21 | 24.50 | 7.35 | 10.26 | 5.22 | 8.76 | 0.62 | 1.91 | 5.85 | 10.06 |
| 18H00 | 125 | 30.03 | 22.55 | 8.50 | 9.84 | 5.57 | 7.97 | 0.55 | 1.79 | 6.11 | 9.16 |
| 19H00 | 125 | 30.76 | 22.79 | 8.16 | 9.60 | 4.53 | 6.04 | 0.51 | 1.38 | 5.03 | 6.90 |
| 20H00 | 125 | 33.86 | 23.82 | 7.18 | 9.64 | 3.84 | 6.36 | 0.47 | 1.09 | 4.31 | 7.20 |
| 21H00 | 125 | 34.37 | 24.28 | 6.49 | 9.52 | 2.87 | 5.16 | 0.39 | 1.38 | 3.26 | 6.19 |
| 22H00 | 125 | 35.14 | 24.83 | 5.96 | 9.47 | 2.58 | 4.88 | 0.30 | 0.70 | 2.88 | 5.45 |
| 23H00 | 125 | 33.03 | 24.45 | 5.23 | 7.44 | 2.63 | 4.48 | 0.34 | 0.73 | 2.97 | 5.06 |
| KW | | 73.213 | | 69.149 | | 68.555 | | 30.208 | | 66.761 | |
| df | | 23 | | 23 | | 23 | | 23 | | 23 | |
| Sig. | | *** | | *** | | *** | | *NS* | | *** | |

Key: ***, $p < 0.001$; MVPA, moderate to vigorous physical activity; *NS*, not significant; SD, standard deviation.

**Table 7:** Relative time spent (%) in sedentary, light, moderate, vigorous and MVPA by police officers at each time of day (00.00 to 23.00).

| Service | Shifts | Sedentary | | Light | | Moderate | | Vigorous | | MVPA | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hours | (n) | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| 00H00 | 62 | 54.44 | 32.63 | 21.55 | 17.54 | 13.48 | 17.63 | 0.85 | 1.58 | 14.33 | 18.55 |
| 01H00 | 62 | 46.59 | 36.28 | 21.81 | 22.47 | 10.90 | 15.24 | 1.34 | 3.15 | 12.25 | 17.66 |
| 02H00 | 62 | 48.99 | 35.95 | 19.72 | 18.57 | 10.76 | 15.46 | 1.17 | 2.19 | 11.94 | 17.46 |
| 03H00 | 62 | 53.40 | 35.49 | 18.34 | 17.31 | 9.78 | 12.29 | 0.74 | 1.29 | 10.52 | 13.13 |
| 04H00 | 62 | 59.58 | 36.59 | 15.08 | 16.30 | 5.54 | 8.33 | 0.44 | 0.98 | 5.98 | 9.06 |
| 05H00 | 62 | 63.87 | 38.03 | 11.06 | 13.41 | 5.41 | 10.68 | 0.31 | 0.94 | 5.72 | 11.25 |
| 06H00 | 62 | 67.01 | 37.36 | 11.34 | 15.78 | 3.57 | 6.52 | 0.35 | 1.10 | 3.91 | 7.49 |
| 07H00 | 62 | 70.16 | 30.73 | 14.17 | 15.02 | 8.52 | 11.41 | 0.70 | 1.27 | 9.22 | 12.35 |
| 08H00 | 136 | 54.33 | 38.14 | 15.13 | 19.09 | 7.92 | 10.97 | 0.56 | 1.32 | 8.48 | 12.02 |
| 09H00 | 136 | 46.42 | 39.53 | 14.35 | 17.36 | 10.33 | 14.56 | 0.96 | 2.39 | 11.29 | 16.12 |
| 10H00 | 136 | 41.55 | 41.49 | 12.81 | 18.72 | 7.39 | 13.28 | 0.75 | 1.66 | 8.14 | 14.72 |
| 11H00 | 136 | 49.05 | 38.69 | 15.83 | 19.20 | 9.23 | 12.57 | 0.89 | 1.69 | 10.12 | 13.70 |
| 12H00 | 136 | 48.88 | 40.32 | 17.70 | 21.90 | 10.61 | 17.53 | 0.75 | 1.94 | 11.36 | 18.72 |
| 13H00 | 136 | 49.56 | 39.37 | 17.83 | 20.21 | 10.65 | 15.37 | 0.64 | 1.61 | 11.28 | 16.00 |
| 14H00 | 136 | 52.78 | 40.44 | 19.09 | 25.88 | 7.96 | 13.39 | 1.06 | 3.31 | 9.02 | 15.68 |
| 15H00 | 136 | 53.26 | 40.45 | 17.86 | 25.20 | 7.25 | 12.06 | 1.04 | 2.66 | 8.29 | 14.22 |
| 16H00 | 125 | 58.97 | 39.89 | 13.94 | 18.95 | 9.29 | 16.36 | 1.00 | 2.81 | 10.29 | 18.10 |
| 17H00 | 125 | 54.75 | 40.30 | 14.67 | 19.13 | 11.68 | 19.69 | 1.30 | 3.71 | 12.97 | 21.67 |
| 18H00 | 125 | 56.05 | 35.60 | 17.60 | 19.44 | 11.02 | 15.23 | 0.93 | 2.98 | 11.95 | 16.92 |
| 19H00 | 125 | 52.83 | 37.25 | 17.84 | 22.18 | 7.62 | 10.05 | 0.91 | 2.46 | 8.53 | 11.53 |
| 20H00 | 125 | 58.53 | 39.51 | 12.85 | 16.72 | 7.02 | 11.17 | 0.80 | 1.82 | 7.82 | 12.48 |
| 21H00 | 125 | 61.18 | 39.83 | 11.60 | 15.97 | 4.97 | 8.64 | 0.66 | 2.31 | 5.63 | 10.33 |
| 22H00 | 125 | 61.61 | 40.55 | 13.90 | 21.75 | 4.77 | 9.17 | 0.51 | 1.18 | 5.28 | 10.03 |
| 23H00 | 125 | 60.71 | 38.98 | 11.34 | 15.12 | 6.40 | 12.09 | 0.75 | 1.64 | 7.15 | 12.97 |
| KW | | 64.933 | | 66.663 | | 73.887 | | 32.371 | | 71.823 | |
| df | | 23 | | 23 | | 23 | | 23 | | 23 | |
| Sig. | | *** | | *** | | *** | | *NS* | | *** | |

Key: ***, $p < 0.001$; MVPA, moderate to vigorous physical activity; *NS*, not significant; SD, standard deviation.

## Discussion

This study aimed to assess the usual PA levels of POs during their operational duties. By utilising accelerometer data, we quantified the PA levels of POs while they performed tasks inherent to police patrol duty. The recorded data provided both absolute (minutes/hour) and relative (%) values of the time spent at each physical activity level (PAL).

Regarding PA during operational performance, in general terms, our findings align with the literature,[22] indicating that PO activity is predominantly sedentary. Specifically, 54.44% of general police service is sedentary, 15.57% is light, 8.42% is moderate, and 0.83% is vigorous. When combining the sedentary and light activity levels, we find that 70% of police service involves low PAL. In contrast, moderate to vigorous physical activity (MVPA) constitutes only 9.25% of a PO daily work. On average, in one hour of PO service, 29 minutes

are sedentary, seven minutes are light, four minutes are moderate, and less than 30 seconds (0.44 minutes) are vigorous, totalling approximately 4.5 minutes of MVPA. Throughout the week, vigorous PAL increased as the weekend approached, culminating on Saturday as the day of the week with the highest incidence of moderate (12.47%), vigorous (1.39%) and, consequently, MVPA (13.85%). On the other hand, although Sunday is the second day of the week with the most time for vigorous PAL (0.56 minutes/hour), this is also the day with the highest level of sedentary (61.85%) and light (21.38%) PAL. The weekend's approach and the inherent social activity may explain why this increase and subsequent decrease from Monday onwards.

PAL variations by shift (night, morning, afternoon) indicate that light, moderate, and MVPA are most frequent during the night shift (00:00 to 08:00). Conversely, tasks requiring vigorous PAL are more common during the afternoon shift (16:00 to 00:00), which also sees the highest levels of sedentary activity, reflecting the dual extremes of PA during this period. This is consistent with societal work patterns, where most incidents requiring PO intervention occur outside typical 9-to-5 working hours.

Finally, after relating PAL to each of the 24 hours of the day, it was observed that, in general, the first hour of the shifts, as well as the end of the eight hours of service, are more sedentary, with 7 am (the last hour of the night shift) being the time with the highest level of sedentary behaviour (70.16%). The time of day with the highest record of vigorous PAL corresponds to 1 am with a percentage of 1.34%. On the other hand, the highest record of MVPA, which is also relevant to our study, is mainly at 00.00 hours. These results clearly show that the approach of the end of the shift duty leads to greater inactivity since it includes handing over duty to the comrades on the next shift. As for the most intense activity during 1 am, this suggests that the most intense crime occurs at night. Although it is infrequent, it is a time when major offences are more likely to occur. These findings suggest that although vigorous activities are sporadic, they are critical and demanding, necessitating readiness for high-intensity events.[23] Looking at the maximum time values (minutes) in activity, we realise a situation that exemplifies the statement in the previous paragraph. The maximum time of vigorous PAL recorded was 17 minutes/hour, which means that the PO carried out a physically demanding operational task during this period. The fact that this action required this PAL for so long tells us that the event was complex in duration and physiologically challenging since maintaining this PAL for so long is highly exhausting. This example shows that the 0.83% associated with vigorous PAL should be considered. On the contrary, the POs must be physically and mentally ready to tackle and resolve incidents of this nature.

Following this idea, Trottier and Brown compare the role of a PO with that of a lifeguard in a swimming pool.[24] This comparison points to aspects in common between the two occupations, such as the time they sit on standby during the shift (i.e., performing a sedentary role) and the need for help that occurs sporadically (perhaps 0.1% of the watch period). Yet, the ability to jump into the water and save a drowning victim is essential to the job's success. That's why the operative sits and watches for the remaining 99.9% of the time.

The same applies to the PO reality, i.e., most of the shift is sedentary, with little or no recourse to physical ability. However, incidents in which physical dexterity and strength are essential occur at short notice. These include chasing suspects who have fled, confronting hostile people and restraining uncooperative individuals. In this way, we can infer that law and order are extremely physically demanding, so any inability to fulfil it would be an apparent security breach. Other physically challenging PO activities are also illustrated, even if unrelated to hand-to-hand disputes, such as water rescue (in rivers and other waterways) or search and rescue operations (both of which can be carried out in adverse weather conditions).

Thus, considering both points of view, we realise that although PO activity is sedentary during most of the shift, there may be inadvertent episodes that require the PO to perform impeccably to guarantee the safety of all those involved. The risks inherent in performing police duties entail various consequences (complex and long-lasting) that affect the efficiency of the measures and activities carried out, which is why it is essential to maintain physical fitness at an appropriate level.[25] When we see this alternation between a state of physical rest (sedentary PAL) and moments of peak intensity (MVPA), we can see that these fewer demanding periods allow the POs to rest and prepare for the eventuality of being called out to incidents that require intense operational skills.

In short, this study's results align with the consensus presented in the literature since, in general terms, research points to POs work as a primarily sedentary activity with peaks of vigorous activity. Most operational time is taken up by patrolling (i.e. sedentary activity), with the peaks of more intense activity corresponding to responding to different types of incidents.

Faced with the evidence that this profession is sedentary, "the question to be asked is whether physical training is still required for modern policing" (p.158).[26] So, in response to the previous question, it is essential to emphasise that safe and effective public order management requires adequate physical fitness, which cannot be achieved through professional routine alone. Moreover, not paying attention to this field can result in a significant risk to public safety.

Given the notorious link between POs' physical fitness and operational efficiency, we can emphasise that all operatives must maintain above-average levels of physical fitness because it makes no sense to select POs based on their physical fitness and capabilities without requiring that the minimum fitness and capabilities be maintained.[27] Finally, it should be noted that the study conducted by Prontenko et al. entitled "Physical Training as a Basis for the Professional Activities of Patrol Officers" clearly emphasises the idea that physical exercise is the foundation for performing the operational tasks inherent in the POs profession.[28] This is widely supported by Burley et al., those who, about the professionalism of a PO, emphasise physical strength as one of the main pillars, with the development of physical capabilities being a crucial and fundamental point in the training of future POs, but also throughout their professional career.[29]

As for the limitations of this research, there needs to be studies with a similar methodology that could serve as a means of comparison. In addition, the methods associated with using accelerometers represent high financial costs, not only for the device itself but also for the software used to process the data, making collecting and analysing information complex and expensive. To overcome the difficulties in future projects, it is suggested that more information be collected, accelerometers be applied in more quantities, and the police context be diversified (e.g., Special Police Unit). In addition, it would be beneficial to take a more targeted approach to characterising police tasks per se, i.e. by looking at the most frequent and physically demanding incidents (particularly those involving MVPA) and categorising the different types of police duties. Additionally, the study is limited by the relatively small sample size of 32 POs, which may affect the generalizability of the findings to broader law enforcement populations. Variability in adherence to the accelerometer protocol among participants could also have influenced the accuracy of physical activity measurements.

Furthermore, the study did not control for potential confounding factors, such as environmental conditions or fluctuations in workload intensity, which could impact physical activity patterns. Lastly, given the cross-sectional design, causal relationships between physical activity levels and health or performance outcomes must be more definitively established. Future research should consider addressing these limitations by expanding the sample size, diversifying the contexts and roles of POs studied (e.g., including Special Police Units), and incorporating longitudinal designs to understand causality better. Additionally, integrating more cost-effective methods or securing funding for advanced tools could make the data collection process more accessible and efficient. To sum up, this study provides

crucial and transparent information (i) to understand the variability of PA associated with police service (different shifts, day of week and hours of the day) and (iii) to adjust institutional health policies and to optimise police performance.

The findings of this study have significant implications for the development of occupational health policies and training programs for law enforcement. Given the predominantly sedentary nature of police work interspersed with moments of high-intensity physical demands, it is crucial to implement structured physical activity programs tailored to the needs of POs. These programs could focus on increasing overall daily activity and improving physical readiness for emergencies. Policymakers might consider integrating routine physical conditioning into work schedules, emphasising aerobic and anaerobic exercises to ensure officers maintain the necessary fitness levels. Additionally, the insights gained from characterising activity patterns across different shifts and times of day could inform targeted interventions to reduce sedentary behaviour during less active periods and enhance performance during critical incidents. These measures would promote better health outcomes for officers and improve operational efficiency and public safety.

## Conclusions

Focusing on POs' PA specifically during police service, we found that police activity, in general terms, is sedentary, with little time spent on vigorous PAL. As a result of this objective assessment of PO service, we found that: (i) the time spent on sedentary, light, moderate, vigorous and MVPA during the PO work underwent statistically significant changes; (ii) the day of the week had a statistically significant effect on the time spent on the different PAL; (iii) the shift of service (evening; morning; afternoon) had a statistically significant effect on the time spent on sedentary PA, light, moderate, vigorous and MVPA in the performance of police work; and (iv) the time of day had a statistically significant effect on the time spent in the different PAL. In summary, this study enhances academic knowledge by quantifying the PA of Portuguese POs during their service, providing a deeper understanding of their performance in contemporary contexts.

Future research should aim to explore the long-term effects of interventions designed to reduce sedentary behaviour among POs and investigate the role of personalised training programs in enhancing physical performance and health outcomes. Longitudinal studies are recommended to understand better how shifts and varying work conditions influence physical and mental health over time. Additionally, examining the impact of integrating

physical activity into daily routines on individual well-being and operational effectiveness could provide further insights for policy development.

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## Endnote

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