emergency care and medicine

MDPI

Article

Anthropometric Characteristics and Fitness Status of Emergency Medical Services (EMS) Personnel

Koulla Parpa * and Marcos Michaelides *

Faculty of Sports and Exercise Science, Cyprus Campus, University of Central Lancashire, University Avenue 12-14, Pyla 7080, Cyprus
* Correspondence: kparpa@uclan.ac.uk (K.P.); mmichaelides@uclan.ac.uk (M.M.)

Abstract

Background/Objectives: This study aimed to assess the anthropometric and body composition characteristics, blood profiles and fitness-related parameters of emergency medical services (EMS) professionals. **Methods**: A total of 39 EMS professionals participated in the study, consisting of 18 males (age: 37.78 ± 10.62 years, height 180.87 ± 6.00 cm, weight 105.42 ± 25.40 kg) and 21 females (age: 33.05 ± 7.44 years, height 167.29 ± 3.89 cm, weight 90.63 ± 21.20 kg). The testing included anthropometric measurements, blood profiling, handgrip and low back strength assessments, vertical jump evaluation, flexibility testing, sit-up and push-up assessments, as well as timed performance measurements for a 300 m sprint and a 1.5-mile run. **Results**: According to the body mass index (BMI), 41% of the EMS professionals were classified as obese. Self-reported data indicated a smoking prevalence of 23%, while diabetes (n = 3), asthma (n = 2), and hypertension (n = 2) were also reported. Our results reveal that a great proportion of EMS professionals demonstrated suboptimal body composition and performance levels, with many failing to meet recommended health and performance standards. Elevated BMI, waist and hip circumferences, and body fat percentages were observed, along with relatively low performance in the strength and endurance tests. **Conclusions**: These findings highlight the need for targeted interventions among EMS professionals, who are expected to maintain adequate levels of aerobic capacity, flexibility, muscular strength and endurance.

Keywords: paramedics; ambulance service; fitness; occupational health

Academic Editor: Raimundas Lunevicius

Received: 12 September 2025
Revised: 14 October 2025
Accepted: 17 October 2025
Published: 19 October 2025

Citation: Parpa, K.; Michaelides, M. Anthropometric Characteristics and Fitness Status of Emergency Medical Services (EMS) Personnel. *Emerg. Care Med.* **2025**, *2*, 50. https://doi.org/10.3390/ecm2040050

1. Introduction

Emergency medical service (EMS) professionals are required to respond to emergency and non-emergency ambulance calls, provide medical services to the community, and provide non-emergency medical transport for inter-facility transfers [1]. In addition to responding to calls, they are required to assist the paramedic partner on these calls [1].

Emergency medical service professionals perform physically and mentally demanding [2] tasks which require high levels of physical fitness [3]. Considering that EMS providers frequently engage in activities that require lifting, transporting and carrying patients, they are expected to have certain levels of aerobic capacity, flexibility, as well as muscular strength and endurance [3]. Chapman and colleagues (2007) [3] reported that the physical fitness parameters of Western Australian male paramedics exceeded the normal values for aerobic capacity, muscular strength and muscular endurance, which likely contributed positively to their job performance. Concurrently, high levels of physical fitness have also been shown to be associated with the quality of chest compressions and lower incidence of rescuer fatigue during cardiopulmonary resuscitation [4]. Conversely, research conducted by Mthombeni, Noorbhai and Coopoo (2020) [5], which assessed the fitness levels of rural emergency medical and rescue providers in South Africa, demonstrated that many of the study participants were not physically fit to perform their required occupational duties. In their study, the prevalence of obesity was high for both male and female emergency care providers. Also, the majority of the participants demonstrated poor aerobic capacity, grip strength, lower body strength and muscular endurance, as measured by the push-up test, one-minute sit-up test, and flexed arm hang test [5].

At the same time, research suggests that insufficient core and lower body strength and flexibility, combined with the physically demanding nature of the EMS tasks, may increase the risk of work-related injuries among EMS professionals [6]. In addition, high body fat and pre-hypertensive blood pressure indicate an increased risk of cardiometabolic disease within the EMS group [6]. In a similar study, researchers suggested that core, upper and lower body strength as well as upper body flexibility were significantly lower in older paramedics compared to their younger counterparts in Australia [7]. Last but not least, a systematic review of 24 articles concluded that paramedics have poorer health status and fitness levels compared to the general population, despite frequently performing physically demanding tasks [8].

Based on the aforementioned studies, it is clear that anthropometric and fitness assessments can provide valuable insights into the individual fitness levels and readiness of EMS professionals. These assessments may be essential for identifying specific areas where tailored programs could be implemented to improve performance and reduce injury risk in this physically and mentally demanding profession. While some research has been conducted on EMS providers, the available published data is limited. Therefore, this study aimed to assess the anthropometric and body composition characteristics, blood profiles and fitness-related parameters of EMS professionals.

2. Materials and Methods

2.1. Participants

A total of 39 EMS professionals from Northwest Arkansas were recruited for this cross-sectional observational study. The group included 18 males (age: 37.78 ± 10.62 years, height 180.87 ± 6.00 cm, weight 105.42 ± 25.40 kg) and 21 females (age: 33.05 ± 7.44 years, height 167.29 ± 3.89 cm, weight 90.63 ± 21.20 kg) who serve as emergency medical responders. At the time of the testing, there were 45 EMS professionals in the city; however, six were unable to complete the measurements. Consequently, the included sample represents 87% of the total EMS professionals in the city. Exclusion criteria for participation included any musculoskeletal injuries that would prevent safe participation in the fitness assessments, as well as any illness at the time of the testing. It should be noted that all participants worked 24 h shifts, followed by 48 h off.

The presentation and collection of the fitness and anthropometric parameters were aimed at providing the EMS professionals with exercise prescription programs and nutritional guidelines. This study included emergency medical technicians, advanced emergency technicians and paramedics. However, it did not include flight paramedics. Although the sample size was not calculated, similar studies [3] have utilized smaller sample sizes of EMS providers. All participants provided written informed consent, and the study was conducted in accordance with the Helsinki Declaration, with approval obtained from the Institutional Review Board (IRB 05415).

The testing was conducted by the same experienced investigators and included anthropometric measurements, blood profiling, handgrip and low back strength assessments, vertical jump evaluation, flexibility testing, sit-up and push-up assessments, as well as timed performance measurements for a 300 m sprint and a 1.5-mile run. Prior to the assessments, participants were required to complete the Physical Activity Readiness Questionnaire and obtain medical clearance if necessary. All risk factors and lifestyle habits were recorded during the first meeting, and no physical test was conducted until the approval of the medical practitioner. The testing was conducted over three separate days between 9:00 and 11:00 am to minimize variability due to circadian influences and ensure consistent environmental and physiological conditions across participants. The tests were conducted in the same order as in previous studies [9], with sufficient rest between them to minimize potential fatigue. On the first day, participants underwent anthropometric, body composition and blood pressure assessments. At the same time, they were required to provide blood test results, which had been conducted in a clinically accredited laboratory the week before the commencement of the project. On the second day, they completed physical assessments indoors, while on the third day, they performed two running tests outdoors.

2.2. Anthropometric and Body Composition Assessment

Stature and body mass were assessed according to the guidelines using a wall stadiometer and a leg-to-leg bioelectrical impedance analyzer (BIA) (model BF-322, Tanita Corporation of America Inc., Arlington Heights, IL, USA), respectively. The leg-to-leg bioelectrical impedance analysis was also used to determine body fat (%) and fat-free mass. Before the testing, the participants were instructed to adhere to the following guidelines: (1) refrain from eating or drinking for 4 h before the test, (2) avoid exercise for 12 h before the test, (3) abstain from alcohol consumption for 48 h leading up to the test, and (4) ensure their bladder is empty 30 min before the test.

Hip and waist circumferences were obtained following the guidelines regarding the anatomical placement of the measuring tape, its tightness, the participant's posture, phase of respiration, abdominal tension and clothing [10]. The same experienced investigator conducted the measurements twice, which were recorded for the calculation of waist-to-hip ratios. Systolic and diastolic blood pressures were recorded in a seated position after a 10 min rest. Measurements of blood pressure were recorded twice by the same experienced investigator. Also, during the first day of the measurements, the participants provided their blood test results, which were obtained in a clinically accredited laboratory after overnight fasting and included results on triglycerides, serum low-density lipoprotein (LDL), high-density lipoprotein (HDL), total cholesterol, and fasting glucose levels.

2.3. Physical Assessments (Days 2 and 3)

Upon entering the room, participants were asked to sit comfortably and relax for five minutes. After this rest period, an investigator recorded their radial pulse for one minute. Thereafter, they completed a 5 min warm-up on a mechanically braked cycle ergometer (Monark Ergomedic 894E Peak Bike, Vansbro, Sweden), followed by a 5 min dynamic stretching before proceeding with the physical assessments.

2.3.1. Measures of Muscular Endurance

The number of push-ups and sit-ups performed was used as a measure of muscular endurance. The one-minute sit-up test was used to assess abdominal muscle endurance based on previously described methods [11]. The EMS providers were instructed to lie on their backs, with knees bent and arms crossed in front of their chest and hands on their shoulders. A research investigator held their feet flat on the floor and was responsible for counting the properly performed sit-ups. The total number of sit-ups was recorded at the end of one minute. The maximum push-up test [12] was utilized to measure upper-body muscle endurance. Participants lay face down in a prone position with their arms bent, body straight, and hands placed flat on the floor beneath their shoulders. A 5 cm high sponge was positioned on the floor to ensure contact with the chest during the downward phase of the push-up. A research investigator recorded the number of correct push-ups that were performed without any rest.

2.3.2. Vertical Jump Test

Explosive strength power was evaluated using the countermovement jump test. The jump performance was assessed using the Optojump photoelectric cells (Microgate, Bolzano, Italy) following the procedures described by previous investigators [13]. Each participant performed three jumps with equal rest periods between them, and the best score was recorded for analysis.

2.3.3. Low Back Strength

A low back dynamometer (Takei Back and Leg Dynamometer, Takei Scientific Instruments Co., Ltd., Niigata, Japan) was used to assess low back strength. The participants were instructed to place their feet on the base while the hand-grip chain was adjusted to accommodate individual height differences. They were then instructed to exert the maximum isometric pull force using only their trunk muscles. A researcher was responsible for the correct execution of the isometric movement and the recording of the reading that was displayed on the dynamometer.

2.3.4. Sit-and-Reach Test

The sit-and-reach test was used to assess the flexibility of the lower back and hamstring muscles. A traditional sit-and-reach box (32.4 × 53.3 × 23 cm) was placed against the wall, and the participants were instructed to sit in front of the box barefoot with knees fully extended and heels positioned against its edge. They were then asked to place one hand on top of the other (palms facing downward) and slowly reach forward along the measuring scale. To ensure complete leg extension, a researcher held one hand lightly against the participant's knees. They were allowed to perform the test 3 times, and the best score was recorded to the nearest centimeter.

2.3.5. Handgrip Strength Test

A handgrip dynamometer (Takei Scientific Instruments Co., Ltd., Tokyo, Japan) was used to evaluate the maximum isometric strength of the forearm and hand muscles. The test was carried out following the procedure outlined by previous researchers [14] for both the right and left hands. The participants were instructed to perform the test twice with each hand, and the best score for recorded.

2.3.6. 300 m Run Test

During the third day of testing, the EMS personnel performed two field tests. Before performing the 300 m test, they completed a 5 min warm-up led by a qualified instructor. Following the warm-up, they were instructed to run 300 m at maximal speed on a predetermined course around an outdoor field track. Each participant completed the test individually, and the time taken to cover the 300 m was recorded by an experienced investigator. The timing was conducted via a stopwatch, with the testers having undergone training in stopwatch timing procedures for various running tests. Participants were allowed to rest for approximately 10 min before beginning the next test.

2.3.7. 1.5-mile (2.414 km) Run Test

The 1.5-mile run test was completed after a 10 min rest period following the 300 m test [9]. The objective of the 1.5-mile run was to run the distance as fast as possible. This test was performed only once, and the individual times were recorded by the experienced investigators using a stopwatch.

2.4. Statistical Analysis

Analysis was performed using SPSS, version 28.0, for Windows (SPSS Inc., Chicago, IL, USA). The normality assumption was assessed with the Shapiro–Wilk test ($p > 0.05$). All parameters were presented as means and standard deviations, as the hypothesis for normal distribution was retained. Although comparing male and female participants was beyond the scope of this study, the data were presented separately for males and females due to the significant differences between the two genders. Sex comparisons were presented alongside population norms where applicable.

3. Results

Table 1 presents the anthropometric, body composition, and blood pressure parameters, including population values where applicable. According to anthropometric characteristics (BMI), 41% of the EMS personnel were categorized as obese. Based on self-reported data, smoking prevalence was 23%, while diabetes (n = 3), asthma (n = 2), and hypertension (n = 2) were also reported.

Table 1. Anthropometric, body composition and blood pressure measurements are presented as means ± standard deviation.

Parameter	Group (n = 39)	Males (n= 18)	Females (n= 21)
Age (years)	35.23 ± 9.24	37.78 ± 10.62	33.05 ± 7.44
Height (cm)	173.56 ± 8.44	180.87 ± 6.00	167.27 ± 3.89
BMI (kg/m^2) [a]	32.38 ± 7.54	31.90 ± 7.05	32.80 ± 8.09
Weight (kg)	97.46 ± 24.10	105.42 ± 25.40	90.64 ± 21.20
Waist (cm) [b]	103.89 ± 18.65	109.15 ± 19.51	99.39 ± 17.05
Hip (cm) [c]	113.99 ± 13.21	110.46 ± 10.84	117.02 ± 14.52
Waist-to-hip ratio [d]	0.91 ± 0.11	0.98 ± 0.10	0.85 ± 0.07
Body fat (%) [e]	38.60 ± 12.30	32.14 ± 10.46	44.13 ± 11.18
SBP (mmHg) [f]	126.85 ± 14.27	131.44 ± 15.07	122.90 ± 12.59
DBP (mmHg) [g]	83.08 ± 13.47	87.89 ± 14.21	78.95 ± 11.59

Note: SBP: systolic blood pressure, DBP: diastolic blood pressure. [a] BMI ≥ 30 kg/m^2 = obese. [b] Waist circumference > 94 cm (males) or >80 cm (females) = high risk. [c] Hip circumference 97–108 cm (males) and 94–105 cm (females) = normal range. [d] Waist-to-hip ratio ≥ 0.90 (males) or ≥0.85 (females) = increased risk. [e] Normal body fat: 18–24% (males), 25–31% (females). [f] Normal systolic blood pressure: ~120 mmHg (males), 110–120 mmHg (females). [g] Normal diastolic blood pressure: <80 mmHg.

The hematological parameters and lipid profiles are summarized in Table 2, including the normal reference values. The results indicated that females had higher HDL levels and a lower total cholesterol/HDL ratio compared to males.

Fitness and performance parameters are presented in Table 3, including the normal reference values.

Table 2. Hematological parameters and lipid profile are presented as means ± standard deviation.

Parameter	Total Group (n = 39)	Males (n = 18)	Range	Females (n = 21)	Range
Total cholesterol (mg/dL) [a]	164.62 ± 29.4	157.00 ± 28.35	100–194	171.14 ± 29.37	111–230
HDL (mg/dL) [b]	38.64 ± 13.74	31.22 ± 8.78	22–55	45.00 ± 14.18	28–83
LDL (mg/dL) [c]	109.87 ± 25.3	109.94 ± 25.0	66–141	109.81 ± 26.21	61–160
Triglycerides (mg/dL) [d]	93.74 ± 57.60	96.61 ± 49.02	50–189	91.29 ± 65.17	50–329
Ratio of total cholesterol/HDL [e]	4.60 ± 1.25	5.26 ± 1.20	3.3–7.2	4.03 ± 0.99	2.0–5.6
Glucose (mg/dL) [f]	75.36 ± 18.74	80.06 ± 25.11	56–148	71.33 ± 9.73	53–88

Notes: [a] Total cholesterol: <200 mg/dL considered desirable. [b] HDL: ≥40 mg/dL (males), ≥50 mg/dL (females) is considered normal. [c] LDL: 100–129 mg/dL is considered near normal. [d] Triglycerides: ≤150 mg/dL is considered normal. [e] Total cholesterol/HDL ratio: ≤5 (males), ≤4 (females) is considered normal. [f] Glucose: 70–99 mg/dL is considered the normal fasting range.

Table 3. Fitness and performance measurements are presented as means ± standard deviation.

Parameter	Group (n = 39)	Males (n= 18)	Females (n= 21)
CMJ (cm) [a]	16.21 ± 4.76	18.94 ± 4.15	13.86 ± 3.97
Left handgrip strength (kg) [b]	39.31 ± 10.47	45.42 ± 8.39	34.06 ± 9.28
Right handgrip strength (kg) [b]	41.99 ± 13.14	50.43 ± 11.74	34.75 ± 9.58
Back strength (kg) [c]	90.08 ± 40.00	114.34 ± 36.10	69.28 ± 30.80
Relative back strength (N/kg)	0.95 ± 0.41	1.12 ± 0.34	0.80 ± 0.42
Flexibility (cm) [d]	15.76 ± 3.95	13.48 ± 2.98	17.72 ± 3.66
Sit-ups (per minute) [e]	19.82 ± 10.60	24.33 ± 10.04	15.95 ± 9.68
Push-ups (max #) [f]	18.00 ± 9.78	20.17 ± 10.16	16.14 ± 9.28
300 m (sec) [g]	84.46 ± 26.17	73.98 ± 23.76	93.44 ± 25.26
1.5 mile (minutes) [h]	19.49 ± 4.88	17.96 ± 5.41	20.79 ± 4.07

Notes: [a] CMJ (countermovement jump): males 45–55 cm; females 36–46 cm (athletic population norms). [b] Handgrip strength: males ~42–43 kg; females ~24–28 kg (general population norms). [c] Back strength: males ~141 ± 18 kg; females ~82 ± 13 kg. [d] Flexibility (sit-and-reach): males 23–27 cm; females 29–32 cm. [e] Sit-ups (1 min): males 30–40; females 20–30. [f] Push-ups (max): males 21–28; females 19–20. [g] 300 m run: males 54–59 s; females 65–71 s. [h] 1.5-mile run: males < 10.45 min; females < 13.31 min, #: number.

4. Discussion

Our results indicate that a great proportion of EMS personnel demonstrated suboptimal body composition and performance levels, with many not meeting the recommended health and performance norms. Elevated BMI (kg/m^2), waist and hip circumferences, and fat percentages were observed along with relatively low performance in the strength and endurance tests. These findings highlight the need for targeted interventions among EMS providers, who are expected to maintain adequate levels of aerobic capacity, flexibility, muscular strength and endurance [3].

According to the anthropometric characteristics, 41% of the participants had a BMI over 30, classifying them as obese. These results are more concerning than those reported for EMS personnel in Saudi Arabia [15]. In a study by Aljerian and colleagues (2018) [15], the obesity prevalence was 19.2%, while 41.4% of the participants were classified as overweight, and 36.1% fell within the normal BMI range. In a similar study [16] on 370 EMS responder candidates for fire and ambulance services in Massachusetts, it was reported that 77% of the participants had BMI values greater than or equal to 25 kg/m^2, while 33% were obese.

The authors demonstrated that higher BMI was associated with increased blood pressure, a worse metabolic profile and lower exercise tolerance. These cross-country differences in obesity prevalence among EMS professionals may be influenced by cultural, occupational and systemic factors. For example, higher obesity rates reported in the United States could reflect greater exposure to sedentary lifestyles, longer work hours, higher availability of calorie-dense foods, and limited access to healthy meals during shifts. In addition, differences in national health policies, physical fitness requirements for employment and workplace wellness programs may contribute to the observed variation.

Previous research [17] also indicates that most EMS employees (75%) do not meet the recommended minimum levels of physical activity, which may contribute to the high body fat and BMI levels observed. Furthermore, studies have shown that paramedics tend to experience an increase in BMI over their years of employment, often leading to obesity [18]. The study above revealed that among the examined factors, tobacco use, supervisor support and emotional eating had a significant impact on BMI [18]. Furthermore, a study on EMS personnel in North Carolina demonstrated a high prevalence of overweight and obesity, heavy drinking, binge drinking, and high blood pressure compared to the general population [19]. In our study, the mean blood pressure values were only slightly elevated. However, when the individual values were considered, it was evident that some participants had elevated blood pressures, with systolic values reaching up to 162 mmHg and diastolic values up to 110 mmHg. Similarly, while the mean waist-to-hip ratio suggested a moderate risk for both male and female personnel, an analysis of individual values indicated that some were at high risk [10], with ratios reaching 1.15 in males and 0.94 in females. Likewise, a systematic review, including studies from European and international EMS populations, demonstrated that excess weight and cardiovascular disease risk factors such as hypertension and poor dietary habits are prevalent among paramedics and EMS professionals, although these rates may still be comparable to those observed in the general population [8].

Regarding the blood lipid profiles, both male and female EMS personnel exhibited HDL levels below the recommended minimum values (Table 2). In addition, while mean values for the LDL/HDL ratio were considered normal for both genders, individual values indicated that some individuals had significantly higher ratios than recommended. Research suggests that both LDL cholesterol and HDL cholesterol are good indicators for evaluating the risk of heart disease, with the LDL/HDL ratio being a better predictor of heart disease than LDL-C alone [20]. Furthermore, mean triglycerides and glucose values were within the normal range, although some individual scores were elevated (Table 2). Similar studies have shown a high prevalence of metabolic syndrome among EMS providers at an early age [21]. A large study further suggests that the most common factors that influence the prevalence of metabolic syndrome are blood pressure and waist circumference [22].

In our study, the average CMJ scores for EMS personnel were below average for both males and females compared to adult athletes [23]. Since no previous studies assessing CMJ in EMS personnel have been identified, a direct comparison with existing research is not possible. Therefore, the interpretation of the CMJ score in EMS personnel should be performed with caution, as the comparison was performed against athletes. In addition, both male and female participants demonstrated very good handgrip strength compared to a population-based study [24]. The values for the dominant hand in males were comparable to those reported for conventional Western Australian male paramedics [3]. Furthermore, both male and female EMS personnel demonstrated relatively good isometric back strength, considering the participants' average age [25].

Flexibility in the back and hamstring muscles was poor, with participants showing significantly lower values compared to conventional Western Australian male paramedics [3]. Both male and female participants scored below the minimum average values for flexibility, indicating that their flexibility scores were among the lowest compared to the general population of the same age range [26]. This finding is of particular importance, as limited flexibility is often associated with an increased risk of musculoskeletal issues such as back injuries [27]. Reduced flexibility in key muscle groups, such as the hamstrings, hip flexors, and lower back, should be regarded as an issue, especially for EMS personnel who are often required to lift and carry heavy individuals.

The average number of sit-ups performed in one minute placed our participants in the 'below average' category compared to the general population [28], although their results were similar to those observed in other EMS personnel [3]. The relationship between strong adnominal muscles and the diminished incidence of low back pain has been reported by several investigators [29]. Strong abdominal muscles play an essential role in stabilizing the spine and supporting an appropriate posture, especially during actions such as lifting, carrying and moving individuals, which are common activities performed by EMS personnel. Regarding the average number of push-ups, our participants were categorized as 'average' compared to the general population [28]; however, their scores were significantly lower compared to those performed by conventional Western Australian male paramedics [3]. Nevertheless, the maximum push-up test results of our male participants were comparable to those reported in a pilot study on emergency care providers in the Northwest Province of South Africa [30]. Last but not least, our EMS participants demonstrated poor performance in the 300 m run test and very poor performance in the 1.5-mile run test compared to the general population [28], indicating limitations in their anaerobic and aerobic endurance, respectively. These results can be of great importance considering that they have to perform high-intensity tasks and sustain prolonged physical exertion in emergency events.

To address these physical fitness challenges, several evidence-based strategies can be implemented within EMS organizations. Regular mandatory fitness assessments could help track health status and encourage accountability among personnel. Also, collaborations with occupational health specialists and exercise professionals can result in the development of structured wellness and conditioning programs tailored to the physical demands of the job. These programs should also include sex-specific components, recognizing that female EMS professionals may benefit from greater emphasis on upper body and core strength, while taking into account the hormonal differences between male and female EMS professionals. In addition, workplace policies promoting healthy nutrition, rest and opportunities for physical activity during shifts can further support fitness maintenance. Managerial commitment and a positive organizational culture that values health and readiness are essential to sustain long-term improvements. Finally, continuous education on fitness, ergonomics and stress management may empower EMS professionals to maintain their physical and mental well-being throughout their career.

5. Conclusions

Our results reveal significant concerns regarding the body composition and physical fitness of EMS personnel. Participants indicated elevated BMI, waist and hip circumference and body fat content. In addition, poor flexibility, low vertical jump performance and reduced core strength, combined with low aerobic and anaerobic fitness, may negatively impact job performance and increase the risk of musculoskeletal problems.

Considering the demanding nature of EMS work, targeted, evidence-based interventions are necessary to improve the overall health and physical readiness of this workforce.

For EMS managers, implementing regular fitness assessments and structured wellness programs could help identify individuals at risk and support early intervention. Public health and organizational policies should prioritize mandatory physical fitness standards and provide resources for ongoing health promotion initiatives.

Future studies should focus on the development and evaluation of structured physical activity programs that aim at improving body composition and cardiovascular fitness among EMS personnel. Special emphasis should be placed on the prevention of health problems related to cardiovascular risks and musculoskeletal disorders. In addition, longitudinal interventions are recommended to assess the effectiveness of tailored programs and to explore how improvements in physical condition may reduce injury rates and improve the overall well-being of this occupational group. Lastly, future research should consider comparative analyses between EMS personnel across multiple jurisdictions within the United States and internationally.

Limitations

This study comes with limitations. In addition to the small sample size, a great limitation is that participants were not examined based on different age categories. Considering the wide age range of participants (19–56 years), comparing different age groups would have been more appropriate. However, the small sample size did not allow for the separation of groups into different age categories. In addition, running tests were measured using a manual stopwatch rather than an electronic timing system. The use of manual timing introduces the possibility of human error, whereas more objective methods would have provided greater reliability and accuracy. Also, nutritional information was not gathered, and the participants were not separated based on their position. Furthermore, a key methodological limitation is the use of BIA to estimate body fat percentage. BIA provides an estimation rather than a direct measurement of body composition, and its accuracy can be influenced by several factors, including hydration status. Future studies are encouraged to include total body water data to allow for a more comprehensive assessment. Lastly, the results were obtained from a single U.S state; therefore, they may not be generalizable to broader EMS populations.

Author Contributions: Conceptualization, K.P. and M.M.; methodology, K.P. and M.M.; formal analysis, K.P. and M.M.; investigation, K.P. and M.M.; writing—original draft preparation, K.P. writing—review and editing, K.P. and M.M.; visualization, M.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of the University of Arkansas (IRB 05415, 11 October 2010) for studies involving humans.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data can become available upon request to the corresponding authors.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Hanfling, D.; Altevogt, B.M.; Viswanathan, K.; Gostin, L.O. *Crisis Standards of Care: A Systems Framework for Catastrophic Disaster Response*; National Academies Press: Washington, DC, USA, 1990.
2. Nirel, N.; Goldwag, R.; Feigenberg, Z.; Abadi, D.; Halpern, P. Stress, work overload, burnout, and satisfaction among paramedics in Israel. *Prehosp. Disaster Med.* **2008**, *23*, 537–546. [CrossRef]

3. Chapman, D.; Peiffer, J.; Abbiss, C.R.; Laursen, P.B. A descriptive physical profile of Western Australian male paramedics. *Australas. J. Paramed.* **2007**, *5*, 1–11. [CrossRef]
4. Russo, S.G.; Neumann, P.; Reinhardt, S.; Timmermann, A.; Niklas, A.; Quintel, M.; Eich, C.B. Impact of physical fitness and biometric data on the quality of external chest compression: A randomised, crossover trial. *BMC Emerg. Med.* **2011**, *11*, 20. [CrossRef]
5. Mthombeni, S.K.; Noorbhai, H.; Coopoo, Y. Fitness levels of rural emergency medical and rescue service providers in the Northwest province, South Africa. *Occup. Health South Afr.* **2020**, *26*, 111–116.
6. Hunter, J.; MacQuarrie, A.; Sheridan, S.; High, R.; Waite, C.; Smith, K.; Wheat, J. Health and fitness status of Australian paramedics: A cause for concern. In Proceedings of the Health, Wellness & Society Conference, London, UK, 20–21 September 2018.
7. Hunter, J.R.; Macquarrie, A.J.; Sheridan, S.C. Physical capacity of New South Wales ambulance paramedics. *Occup. Med.* **2019**, *69*, 534–540. [CrossRef]
8. Sheridan, S. Paramedic health status, fitness, and physical tasks: A review of the literature. *Australas. J. Paramed.* **2019**, *16*, 1–7. [CrossRef]
9. Orr, R.M.; Dawes, J.J.; Pope, R.; Terry, J. Assessing differences in anthropometric and fitness characteristics between police academy cadets and incumbent officers. *J. Strength Cond. Res.* **2018**, *32*, 2632–2641. [CrossRef]
10. World Health Organization. *Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation*; WHO: Geneva, Switzerland, 2008.
11. Parpa, K.; Michaelides, M. Age-related differences in physical fitness and performance of an "Ability Test" among firefighters. *Muscles* **2024**, *3*, 88–99. [CrossRef]
12. Michaelides, M.A.; Parpa, K.M.; Thompson, J.; Brown, B. Predicting performance on a firefighter's ability test from fitness parameters. *Res. Q. Exerc. Sport* **2008**, *79*, 468–475. [CrossRef]
13. Michaelides, M.A.; Parpa, K.M.; Henry, L.J.; Thompson, G.B.; Brown, B.S. Assessment of physical fitness aspects and their relationship to firefighters' job abilities. *J. Strength Cond. Res.* **2011**, *25*, 956–965. [CrossRef]
14. Reijnierse, E.M.; de Nynke, J.; Marijke, C.T.; Gerard, J.B.; Gillian, B.B.; Helena, G.; Jean-Yves, H. Assessment of maximal handgrip strength: How many attempts are needed? *J. Cachexia Sarcopenia Muscle* **2017**, *8*, 466–474. [CrossRef]
15. Aljerian, N.; Alshehri, S.; Masudi, E.; Albawardi, A.M.; Alzahrani, F.; Alanazi, R. The prevalence of musculoskeletal disorders among EMS personnel in Saudi Arabia, Riyadh. *Egypt J. Hosp. Med.* **2018**, *73*, 5777–5782. [CrossRef]
16. Tsismenakis, A.J.; Christophi, C.A.; Burress, J.W.; Kinney, A.M.; Kim, M.; Kales, S.N. The obesity epidemic and future emergency responders. *Obesity* **2009**, *17*, 1648–1650. [CrossRef]
17. Studnek, J.R.; Bentley, M.; Mac Crawford, J.; Fernandez, A.R. An assessment of key health indicators among emergency medical services professionals. *Prehosp. Emerg. Care* **2010**, *14*, 4–20. [CrossRef]
18. Hegg-Deloye, S.; Corbeil, P.; Brassard, P.; Prairie, J.; Larouche, D.; Jauvin, N.; Carmichael, P.; Poirier, P.; Tremblay, A. Work-related and dietary factors associated with weight gain over the period of employment in paramedics. *Occup. Med. Health Aff.* **2014**, *2*, 173. [CrossRef]
19. Brice, J.H.; Cyr, J.M.; Hnat, A.T.; Wei, T.L.; Principe, S.; Thead, S.E.; Delbridge, T.R.; Winslow, J.E.; Studnek, J.R.; Fernandez, A.R.; et al. Assessment of key health and wellness indicators among North Carolina emergency medical service providers. *Prehosp. Emerg. Care* **2019**, *23*, 179–186. [CrossRef] [PubMed]
20. Fernandez, M.L.; Webb, D. The LDL to HDL cholesterol ratio as a valuable tool to evaluate coronary heart disease risk. *J. Am. Coll. Nutr.* **2008**, *27*, 1–5. [CrossRef] [PubMed]
21. Supples, M.W.; Glober, N.K.; Lardaro, T.A.; Mahler, S.A.; Stopyra, J.P. Emergency medical services clinicians have a high prevalence of metabolic syndrome. *Prehosp. Emerg. Care* **2023**, *27*, 449–454. [CrossRef]
22. Rębak, D.; Suliga, E.; Grabowska, U.; Głuszek, S. The prevalence of metabolic syndrome on the sample of paramedics. *Int. J. Occup Med. Environ. Health* **2018**, *31*, 741–751.
23. McMahon, J.J.; Rej, S.J.E.; Comfort, P. Sex differences in countermovement jump phase characteristics. *Sports* **2017**, *5*, 8. [CrossRef]
24. Massy-Westropp, N.M.; Gill, T.K.; Taylor, A.W.; Bohannon, R.W.; Hill, C.L. Hand grip strength: Age and gender stratified normative data in a population-based study. *BMC Res. Notes.* **2011**, *4*, 1–5. [CrossRef]
25. Balogun, J.A.; Olawoye, A.G.; Oladipo, V.A. Isometric back strength in different age groups. *Int. Disabil. Stud.* **1991**, *13*, 87–90. [CrossRef]
26. Hoffmann, M.D.; Colley, R.C.; Doyon, C.Y.; Wong, S.L.; Tomkinson, G.R.; Lang, J.J. Normative-referenced percentile values for physical fitness among Canadians. *Health Rep.* **2019**, *30*, 14–22.
27. Koźlenia, D.; Domaradzki, J. Prediction and injury risk based on movement patterns and flexibility in a 6-month prospective study among physically active adults. *PeerJ* **2021**, *9*, e11399. [CrossRef]
28. Wood, R.J. Complete Guide to Fitness Testing. Available online: https://www.topendsports.com/testing/ (accessed on 8 May 2025).

29. Hibbs, A.E.; Thompson, K.G.; French, D.; Wrigley, A.; Spears, I. Optimizing performance by improving core stability and core strength. *Sports Med.* **2008**, *38*, 995–1008. [CrossRef]
30. Mthombeni, S.; Coopoo, Y.; Noorbhai, H. Correlation between fitness parameters and an occupational rescue simulation among emergency care providers in North West province, South Africa: A pilot study. *Australas. J. Paramed.* **2021**, *18*, 1–7. [CrossRef]