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Comparison of Physical Fitness Between University of Defence Students and Active-Duty Soldiers

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Abstract

Physical fitness is a key element of military readiness. This study compared performance in the 12-minute run and upper-body strength tests between University of Defence students and active-duty soldiers from Land Forces, Air Forces, and the Airborne Regiment (data 2023–2025, age 20–30 years). University of Defence students significantly outperformed Land Forces and Air Forces personnel in the 12-minute run in both sexes. In upper-body strength, students achieved comparable or slightly better results than Land and Air Forces. The Airborne Regiment remained a distinct elite group, recording the highest performance in all disciplines. Performance was highly stable across the three-year period. The results indicate that military university students demonstrate physical fitness levels comparable to or exceeding those of regular active-duty soldiers, while still falling short of the standards of the Airborne Regiment.

KEY WORDS: *physical fitness; military leadership; military students; active-duty soldiers; fitness testing*

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1. Introduction

Physical fitness represents a fundamental component of military readiness and an essential prerequisite for effective performance in military environments. Soldiers are frequently required to perform physically demanding tasks such as prolonged movement, load carriage, obstacle negotiation, or casualty evacuation. The development of physical activity and fitness, particularly from adolescence, plays an important role in shaping long-term physical capacity [1]. Adequate levels of aerobic endurance and muscular strength therefore play a critical role in maintaining operational capability and overall mission effectiveness [2-4].

Beyond its direct contribution to task performance, physical fitness is also traditionally regarded as an important attribute of military leaders. In military culture, physically capable leaders are often perceived as more credible and better able to understand the physical demands placed on their subordinates. Consequently, physical fitness contributes not only to individual readiness but also to leadership authority and the ability to serve as a role model within military units [5,6].

Students of military universities represent future commanders who will be responsible not only for planning and decision-making, but also for leading soldiers in physically demanding conditions. From this perspective, their physical fitness should be at least comparable to that of active-duty personnel. Military educational institutions therefore typically incorporate structured physical training programs and regular fitness assessments as part of the curriculum to ensure that students develop the necessary physical capabilities alongside their professional and academic preparation. Previous research further indicates that physical fitness of military students tends to improve over the course of their studies [7].

Standardized physical fitness tests are widely used across armed forces to evaluate physical preparedness and monitor training outcomes. In military contexts, the validity of standardized fitness tests has been questioned in relation to actual performance demands [8]. Although the specific testing batteries may vary between countries and service branches, they usually assess key components of fitness such as aerobic endurance and muscular strength or endurance. Field tests

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such as running-based assessments and pull-ups are commonly employed due to their practical feasibility and established validity for assessing aerobic endurance and muscular performance [9-11]. Despite the widespread use of these tests, empirical comparisons between military university students and active-duty soldiers remain limited. Such comparisons may provide valuable insight into whether military education systems adequately prepare future officers for the physical demands of service.

Another factor influencing physical fitness outcomes is the diversity of operational roles within different military branches. Units with specialized missions, such as airborne forces, often maintain higher physical standards due to the demanding nature of their tasks. Therefore, when evaluating physical fitness within military populations, it is important to consider potential differences between service branches. At the same time, available evidence suggests that overall physical fitness levels of military personnel may be broadly comparable across different national armed forces, at least in relation to general service requirements [12].

The aim of this study was therefore to compare physical fitness test performance between University of Defence students and active-duty soldiers, to examine differences among selected service branches, and to assess the stability of these differences across a three-year period.

2. Method of Investigation

A retrospective comparative study was conducted using physical fitness testing data collected between 2023 and 2025. The analysis was restricted to individuals aged 20–30 years. The final dataset comprised University of Defence students and active-duty military personnel, categorized into Land Forces, Air Forces, and the Airborne Regiment, which was treated as a distinct subgroup due to its specific operational and training demands.

All participants completed standardized annual fitness testing. University of Defence students followed a fixed protocol consisting of a 12-minute run and an upper-body strength assessment (pull-ups for men; pull-up hold for women). In contrast, active-duty personnel were allowed to choose between alternative aerobic (12-minute run or 300 m swim) and strength disciplines (pull-ups/pull-up hold or sit-ups). Only data from the 12-minute run and upper-body strength tests were included in the present analysis to ensure comparability across groups. Sample sizes reflect voluntary test selection in active-duty personnel.

The final sample sizes were structured by population and discipline. Among men, the University of Defence included 2487 participants in the 12-minute run and 2496 in pull-ups. In the Air Forces, 1367 participants completed the 12-minute run and 919 pull-ups; in the Land Forces, 543 and 372, respectively; and in the Airborne Regiment, 878 and 865, respectively.

Among women, the University of Defence included 587 participants in the 12-minute run and 589 in the pull-up hold. In the Air Forces, 137 participants completed the 12-minute run and 2 the pull-up hold; in the Land Forces, 57 and 0, respectively; and in the Airborne Regiment, 24 and 9, respectively. Due to the very low number of observations in some subgroups, particularly in female upper-body strength tests, these results were interpreted with caution.

Physical performance testing was conducted by physical education specialists using standardized procedures. The tests included:

1. *12-Minute Run.* Participants started collectively and ran for 12 minutes, with the remaining time visible. A signal was given one minute before the end. The distance covered was recorded.
2. *Pull-Ups.* Men performed pull-ups using strict form, starting from a dead-hang position with the body kept straight. Kipping was not allowed. Each repetition required the chin to pass above the bar. The total number of correctly performed repetitions was recorded.
3. *Pull-Up Hold.* Women performed a static hold starting from the pull-up position, using assistance to reach the initial position. The chin had to remain above the bar without contact for as long as possible. The duration was recorded.

Data were analyzed using descriptive statistics. Between-group differences were evaluated using independent t-tests or Mann–Whitney U tests for two-group comparisons, depending on distribution characteristics. For comparisons involving more than two groups, the Kruskal–Wallis test was applied, followed by Nemenyi post-hoc analysis where appropriate. Analyses were conducted on pooled data across all three years as well as on individual yearly cohorts to assess the stability of observed differences over time.

3. Results

Across the three-year period, only minor year-to-year fluctuations were observed, with overall performance remaining stable within groups. This consistency supported the use of pooled data for subsequent analyses. Descriptive statistics for physical performance of men are presented in Table 1.

Table 1: Descriptive statistics of men

UNOB	n	mean	sd	median	min	max	skew	kurtosis
12min	2487	2807,66	186,088	2775	700	3700	0,255	7,082
pull-ups	2496	12,804	4,662	12	0	36	0,535	0,089
AIR								
12min	1367	2758,562	295,283	2750	500	3650	-3,193	22,014
pull-ups	919	12,362	2,553	12	6	30	2,24	10,113
LAND								
12min	543	2762,634	179,837	2710	2000	3350	0,257	1,205
pull-ups	372	12,371	2,83	12	1	33	1,757	11,871
PARA								
12min	878	2935,023	194,787	2980	2300	3660	-0,02	-0,025
pull-ups	865	14,195	3,557	13	1	33	1,468	3,016

The highest mean performance in the 12-minute run was observed in the Airborne Regiment (2935 m), followed by University of Defence students (2808 m), Land Forces (2763 m), and Air Forces (2759 m). A similar pattern was observed in pull-ups, with the Airborne Regiment achieving the highest mean (14.2 repetitions), while the remaining groups showed comparable values (approximately 12.3–12.8 repetitions).

Measures of central tendency and dispersion were generally consistent across groups, although variability was notably higher in the Air Forces for the 12-minute run (SD = 295 m). Distribution characteristics indicated deviations from normality in several variables, particularly in the Air Forces (12-minute run: skewness = −3.19, kurtosis = 22.01) and in pull-ups across all groups (skewness ranging from 0.54 to 2.24).

Significant differences between groups were observed in both the 12-minute run (Kruskal–Wallis: $p = 1.60 \times 10^{-90}$) and pull-ups ($p = 1.78 \times 10^{-35}$). Post-hoc analysis using the Nemenyi test (Table 2) showed that the Airborne Regiment achieved significantly higher performance compared to all other groups in both disciplines (all $p < 0.001$). In the 12-minute run, University of Defence students performed significantly better than both Air Forces ($p = 0.0013$) and Land Forces ($p = 3.54 \times 10^{-6}$), while no significant difference was observed between Air Forces and Land Forces ($p = 0.119$).

In pull-ups, no statistically significant differences were found between University of Defence students, Air Forces, and Land Forces (all $p \geq 0.418$), indicating comparable performance among these groups. In contrast, the Airborne Regiment significantly outperformed all other groups (all $p \leq 3.62 \times 10^{-14}$).

Table 2: Nemeyi post-hoc test for men

12-minute run	UNOB	AIR	LAND
AIR	**0,00130**	-	-
LAND	**3.54×10^{-6}**	0,11892	-
PARA	**0**	**0**	**0**
Pull-ups	UNOB	AIR	LAND
AIR	0,41817	-	-
LAND	0,64555	0,99968	-
PARA	**0**	**$3,62 \times 10^{-14}$**	**$4,27 \times 10^{-14}$**

Descriptive statistics of women showed that the highest mean performance in the 12-minute run was observed in the Airborne Regiment (2620 m), followed by University of Defence students (2462 m), Air Forces (2424 m), and Land Forces (2345 m). In the pull-up hold, the Airborne Regiment also achieved the highest mean duration (53.3 s), followed by Air Forces (42.5 s) and University of Defence students (30.1 s). No data were available for Land Forces in this discipline.

Measures of variability were generally comparable across groups, although slightly higher dispersion was observed in the Air Forces and Airborne Regiment in the 12-minute run (SD ≈ 250 m). Distribution characteristics showed moderate deviations from normality, particularly in University of Defence participants (12-minute run: skewness = 1.02). The detailed descriptive statistics for physical performance of women are presented in Table 3.

Table 3: Descriptive statistics of women

UNOB	n	mean	sd	median	min	max	skew	kurtosis
12min	587	2461,814	161,294	2400	2000	3150	1,017	1,367
Pull-up hold	589	30,122	13,515	28	5	75	0,85	0,217
AIR								
12min	137	2424,168	253,573	2430	1500	3050	-0,323	0,683
Pull-up hold	2	42,5	10,607	42,5	35	50	0	-2,75
LAND								
12min	57	2345,175	212,107	2320	1870	2750	0,215	-0,929
Pull-up hold	0	-	-	-	-	-	-	-
PARA								
12min	24	2620	252,707	2605	2150	3080	0,046	-0,867
Pull-up hold	9	53,333	10,037	51	41	71	0,427	-1,358

Also, significant differences between groups were observed in the 12-minute run (Kruskal–Wallis: $p = 2.27 \times 10^{-6}$) and in the pull-up hold ($p = 5.15 \times 10^{-5}$). Post-hoc analysis (Table 4) for the 12-minute run indicated that the Airborne Regiment outperformed all other groups (all $p \leq 0.00313$). University of Defence students performed significantly better than Land Forces ($p = 0.00063$), but not better than Air Forces ($p = 0.859$). Air Forces also demonstrated significantly better performance than Land Forces ($p = 0.0179$).

In the pull-up hold, the Airborne Regiment achieved significantly higher performance than University of Defence students ($p = 7.68 \times 10^{-5}$), while no significant differences were observed between Air Forces and University of Defence students ($p = 0.312$) or between Air Forces and the Airborne Regiment ($p = 0.877$). No data were available for Land Forces in this discipline. Due to very small sample sizes in some subgroups (Air Forces: n = 2; Airborne Regiment: n = 9), these results should be interpreted with caution.

Table 4: Nemeyi post-hoc test for women

12-minute run	UNOB	AIR	LAND
AIR	0,85861	-	-
LAND	**0,00063**	**0,0179**	-
PARA	**0,00313**	**0,0019**	**$1{,}50 \times 10^{-6}$**
Pull-up hold	UNOB	AIR	
AIR	0,31235	-	
PARA	**$7{,}68 \times 10^{-5}$**	0,87689	

To further illustrate group differences and variability, the distributions of performance in the 12-minute run and the pull-up/pull-up hold are presented using boxplots (Figures 1 and 2).

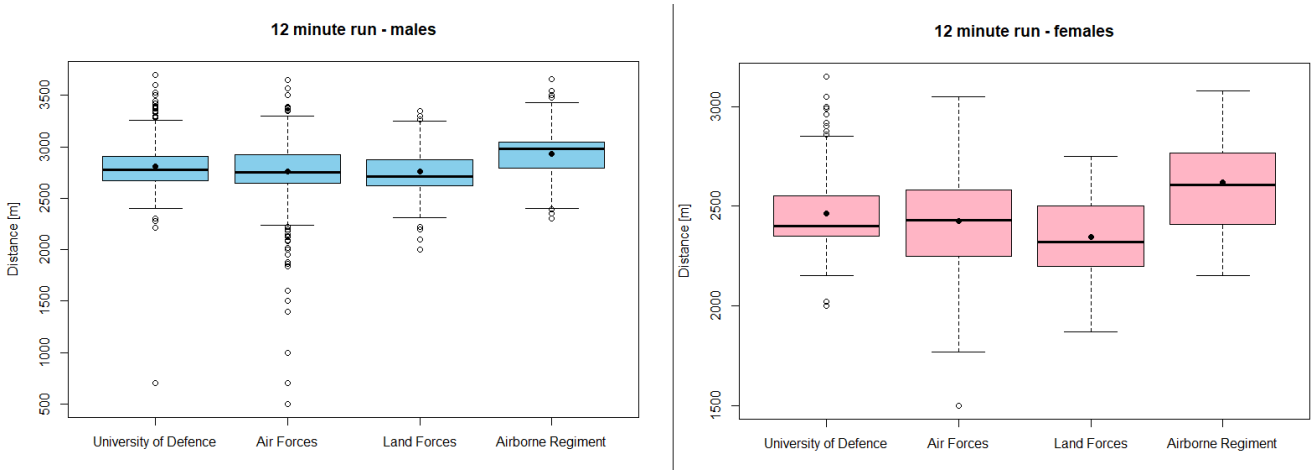

Fig.1. Performances in 12minute run

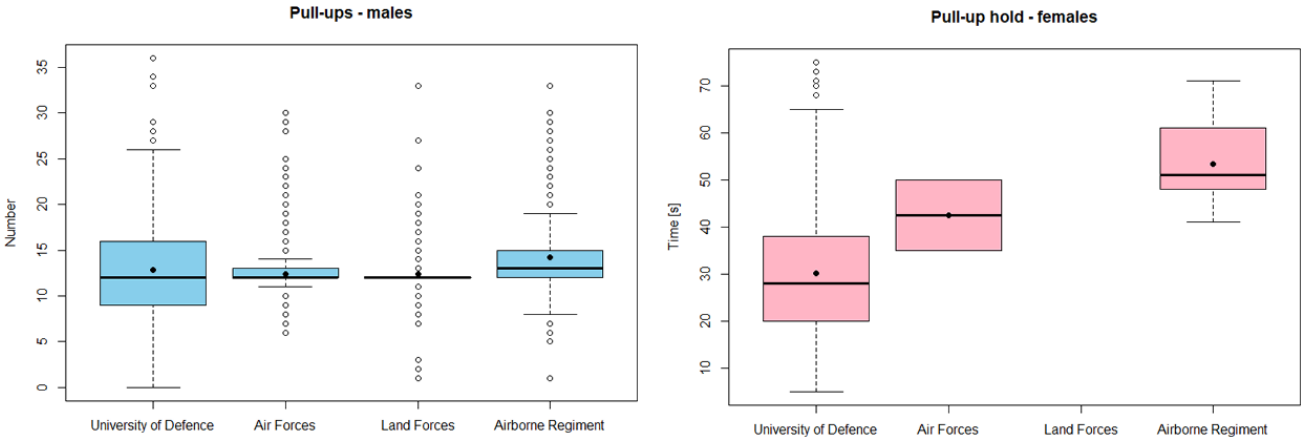

Fig.2. Performances in pulling disciplines

These graphical presentation of the results further demonstrates differences in performance distribution and within group variability across the assessed physical fitness components. The 12 minute run results show distinct patterns in aerobic endurance performance among the study groups, with variation in both central tendency and the spread of individual values. Similarly, the pulling disciplines demonstrate differences in upper body strength and muscular endurance, as reflected by the distribution and dispersion of the observed results. The boxplots complement the statistical findings by illustrating the range and variability of individual performance within each group. Taken together, the results indicate group specific differences across the assessed physical performance measures and provide a basis for their further interpretation.

Limitations. This study is limited by the retrospective design and the elective nature of the active-duty fitness battery. The ability of soldiers to choose between testing disciplines introduces a significant self-selection bias; individuals likely opted for exercises where they anticipated higher performance or a lower risk of failure. Consequently, the data for specific soldier disciplines (e.g., pull-ups and timed holds) may be artificially inflated and represent only a subset of the strongest performers. In contrast, the University of Defence students followed a mandatory, non-elective protocol, making their data the only fully representative sample of a complete cohort's physical capabilities.

An additional limitation relates to the use of performance thresholds within the testing system. In practice, individuals may aim to meet only the minimum required standard rather than achieve maximal performance, while in some cases performance above a certain level may not yield additional benefit within the evaluation system. As a result, recorded test outcomes may not fully reflect true physical capacity, but rather the interaction between individual motivation and the structure of the assessment criteria. This factor may further contribute to variability in the observed results, particularly among active-duty personnel.

4. Conclusions

The study reveals a high degree of stability in physical performance over the three-year period, indicating that current fitness outcomes remain consistent year-to-year. University of Defence students meet the benchmark of comparability, outperforming Land and Air Force personnel in aerobic endurance and maintaining parity in muscular endurance. However, the Airborne Regiment remains a distinct elite tier, significantly outperforming all other groups, including students. While students are physically prepared relative to the average soldier, they do not yet match the specific physical standards demonstrated by high-readiness units like the Airborne Regiment.

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