Review

Work Ability Index (WAI) among Indonesian Military Personnel at Semarang Base: A Study of Officers and Non-Commissioned Officers

Kartika Wira Safitri, Hanifa M. Denny * and Ekawati

Department of Occupational Safety and Health, Faculty of Public Health, Diponegoro University, Kota Semarang 50275, Jawa Tengah, Indonesia
* Correspondence: hanifadenny@live.undip.ac.id

Abstract: Military personnel require a high level of physical and mental capability to handle challenging situations, execute precise actions, and fulfill administrative duties. The substantial physical and mental workload they bear can impact their work ability, potentially hindering their ability to perform optimally. Thus, assessing work ability among military personnel is essential. This study evaluates work ability based on the Work Ability Index (WAI) and examines how age and sex influence work ability scores. This study was conducted at the Semarang Military Base between December 2024 and January 2025 using a cross-sectional design with an analytical observational approach. Semarang Military Base is a service-oriented military unit responsible for providing administrative and logistical support to the elements of the Indonesian Navy. The study population comprised 114 personnel who were actively working at the base. A proportionate stratified sampling method was used to determine the sample, resulting in 90 respondents, consisting of 25 officers and 65 non-commissioned officers. Due to time constraints, data collection was carried out using accidental sampling, whereby personnel present at the base during the data collection period were selected as respondents. The study assessed WAI as the dependent variable, while age and sex served as independent variables. Quantitative methods were employed for data analysis. The findings indicate that most military personnel at Semarang Military Base exhibit good work ability (high WAI scores). A negative correlation was found between WAI and age, indicating that work ability declines as personnel age ($r = -0.320; p = 0.002; \alpha = 0.05$). However, no significant relationship was observed between WAI and sex ($p = 0.264$). Among the seven WAI components, five significantly contributed to the final score, with the second component (work ability relative to job demands) being the most influential. These results highlight that the majority of personnel maintain a strong work ability score, emphasizing the importance of continued evaluation and intervention to sustain their performance.

Keywords: Work Ability Index (WAI); work ability; military personnel

1. Introduction

Work ability (WA) refers to the extent to which workers can physically and mentally perform their jobs while balancing their health, job demands, and personal capabilities [1,2]. Changing workforce demographics and labor demands have necessitated continuous improvements in workability assessments [3,4]. The Work Ability Index (WAI) is a widely used tool that assesses workers' perceptions of their ability to perform tasks effectively [5]. Originally developed in Finland in the early 1980s, the WAI evaluates work ability using a structured questionnaire [6].

WAI plays a crucial role in estimating rehabilitation needs, predicting early retirement due to disability, and assessing trends in absenteeism related to long-term illness [7,8]. The instrument considers both objective and subjective worker characteristics, enabling extended workforce participation, particularly among older employees [9].

Modern military operations occur in highly dynamic environments, which necessitate adaptability and resilience. Military personnel must respond swiftly to threats, endure physical and psychological challenges, and remain flexible to changing conditions [10–12]. Given the complexity of military work, maintaining and enhancing work abilities is crucial.

Military service in Indonesia is conducted through recruitment into the Indonesian National Armed Forces (TNI) through a rigorous selection process and competitive examination. Personnel receive a basic salary according to rank and years of service, along with various allowances and facilities, such as housing, health care, and family support. Although specific numbers for the Semarang Military Base are not publicly disclosed, the base is comprised of personnel of various ranks and cadres, including officers, non-commissioned officers, and enlisted members, who serve in administrative and operational roles. [13]. Interviews with personnel revealed that Officers and Non-Commissioned Officers experienced higher workloads and greater responsibilities than other personnel did. These findings align with prior research indicating that excessive mental and physical burdens contribute to fatigue, stress, and decreased performance [14].

In addition to understanding the physical and psychological demands of military personnel, several studies have examined their ability to maintain work performance under such pressures. A study of Indonesian military reserve members found that many personnel had moderate levels of work ability, with scores influenced by factors such as age, physical fitness, and mental readiness [15]. The results showed that individuals in combat and technical roles tended to report better work performance than those in administrative duties. A study involving 329 male military police officers in Salvador, Bahia, utilized the Work Ability Index (WAI) to classify work ability into four categories: poor (10.3%), moderate (28.9%), good (34.7%), and excellent (26.1%). Overall, the WAI score indicated a predominantly good work ability among the officers [16]. Factors such as homeownership, extended work hours, and obesity were associated with lower work ability scores. Although there is no specific research that reports Work Ability Index (WAI) scores in Indonesia or Southeast Asia, this gap highlights the importance of further exploration and encourages future studies to better understand agility in this regional context.

Additional research is required for female military personnel to assess workload distribution and prevent disruptions to work-life balance [17]. Understanding these factors can assist in optimizing job placements for female personnel.

The Semarang Military Base plays a strategic role in Indonesia's naval operations by providing administrative, logistical, operational, and training support. Established on 29 January 1966, the base remained integral to national security and defense. Given the demanding nature of military work, this study aims to assess WAI scores among personnel, examine the relationships between WAI and demographic factors, and identify the most influential WAI components.

2. Materials and Methods

This study was conducted at the Semarang Military Base between December 2024 and January 2025. This study employed a cross-sectional design, using an analytical observational approach. This quantitative study aimed to examine the dynamics and correlations between the risk factors and outcomes. The cross-sectional approach is characterized by data collection conducted at a single point in time (point-time approach), allowing for the analysis of relationships between variables without establishing causality [18]. This study received ethical approval (Ethical Clearance No. 474/EA/KEPK-FKM/2024).

The Semarang Military Base is a service-oriented military unit responsible for providing administrative and logistical support to the elements of the Indonesian Navy, including the Republic of Indonesia Ships and naval aircraft. In addition to its primary support functions, the base conducts operational and training activities within the area of responsibility. Personnel duties involve both physical and administrative tasks, which demand high levels of mental and physical readiness. Working hours ran from 07:00 to 15:00 WIB, starting and ending with morning and afternoon roll calls, respectively. While most personnel are dismissed after the afternoon roll call, those with additional responsibilities remain on standby until their assigned tasks are completed, either on-site or at external locations, depending on the operational needs.

The study population consisted of 114 individuals, including 32 officers and 82 non-commissioned officers, who worked daily at the Semarang Military Base. These two ranks differ in terms of job responsibilities and training backgrounds. Officers undergo approximately four years of comprehensive academic and military

training, whereas non-commissioned officers usually enter through a shorter, specialized training program lasting around 9 to 12 months.

The study initially adopted a proportionate stratified sampling design to reflect the composition of officers and non-commissioned officers. However, due to operational constraints, the actual data collection was conducted using accidental sampling based on personnel availability during the study period.

The WAI consists of seven items, each of which is assigned a score range. The total WAI scores range from 7 to 49, categorized as follows: poor (7–27), moderate (28–36), good (37–43), and excellent (44–49) [1,2,10]. The WAI used in this study was revised by Ilmarinen and Tuomi in 2005. It comprises seven items, each with a different scoring criteria. Higher total scores indicated better work ability. The questionnaire included demographic data (age and gender) and seven workability-related items: current work ability compared to peak lifetime work ability, work ability relative to job demands, diagnosed medical conditions, estimated work ability reduction due to illnesses, sick leave history over the past year, work ability expectations for the next two years, and mental resources [2,19] (Table 1).

Table 1. Questions on the WAI questionnaire and the distribution of scores.

Question	Possible Scores
Item 1: Current work ability compared with the lifetime best	0–10
Item 2.1: Current work ability in relation tp physical demands	2–10
Item 2.2: Work ability in relation to mental demands	
Item 3: Number of current diseases diagnosed by physician	1–7
Item 4: Estimated work impairment due to diseases	1–6
Item 5: Sick leave during the past 12 months	1–5
Item 6: Own prognosis of work ability 2 years from now	1, 4, or 7
Item 7.1: Enjoying daily tasks	
Item 7.1: Activity and life spirit	1–4
Item 7.3: Optimistic about the future	
Overall WAI	7–49

This study employed both univariate and bivariate analysis. The main outcome variable was the total Work Ability Index (WAI) score, with age, gender, and the seven individual WAI items as independent variables. Age was grouped into specific ranges to support the categorical examination of its association with work ability [2]. This age classification refers to the WAI research that was previously conducted. Univariate analysis was used to describe the distribution of respondents' characteristics and WAI item scores. Normality testing was conducted using the Shapiro-Wilk method to determine appropriate statistical tests. Spearman's rank correlation was used for age, while the Mann–Whitney U test was used for gender to explore the association between demographic factors and work ability. Multiple linear regression analysis was applied to assess the contribution of each WAI item to the total WAI score. To ensure the validity of the instrument and accuracy of the model, internal consistency was examined using Cronbach's alpha, and multicollinearity was evaluated through Variance Inflation Factor (VIF) analysis [20]. VIF is a metric that quantifies the extent of multicollinearity in a set of multiple regression variables by measuring how much the variance of an estimated regression coefficient increases due to collinearity. A VIF value exceeding 10 indicates a high correlation between independent variables, which may distort the regression model. In this study, all VIF values were below 10, suggesting no significant multicollinearity. Although the total WAI scores were not normally distributed, residuals from the regression model were assessed and found to approximate a normal distribution, justifying the use of linear regression.

3. Results

The respondents were categorized into four age groups for analysis: five people (5.6%) aged <30 years, 19 people aged 30–39 years (21.1%), 38 people aged 40–49 years (42.2%), and 28 people aged 50–66 years (31.1%) (Table 2). The majority of the respondents in this study were male, with most participants aged between 40 and 49 years.

Table 2. Individual characteristics of the study respondents.

Individual Characteristics	Number of Subjects	Percentage
Gender		
Man	64	71.1
Woman	26	28.9
Age		
<30	5	5.6
30–39	19	21.1
40–49	38	42.2
50–66	28	31.1

The Shapiro–Wilk normality test indicated that the data did not follow a normal distribution. (p-value < 0.05), respectively. The results of the validity test are presented in Table 3 and were assessed by comparing the calculated r values with the critical r values from the table, along with the corresponding p-values. A validity test was conducted on a sample of 30 participants. The validity test was performed by calculating the correlation between each WAI item score and the total WAI score using Spearman's rank correlation. The critical r value was determined using a significance table for Spearman correlation (critical $r = 0.361$ at $\alpha = 0.05$, n = 30). Each item had an r calculated $>$ critical r and p-value < 0.05, indicating good item validity. The findings showed that all WAI items demonstrated good validity, as each item had a calculated r value greater than the critical r value and a p-value < 0.05. Reliability was assessed using Cronbach's alpha. According to the standard criteria, an instrument is considered reliable if the alpha coefficient exceeds 0.60. The reliability analysis applied to all WAI items produced an alpha value of 0.746, indicating that the instrument reliably measured work ability. Overall, the results of the normality, validity, and reliability tests for the WAI instrument in this study are consistent with those reported in previous studies [5,21].

Table 3. Results of the validity test of the WAI questionnaire.

Item	r Calculate	r Critical	p-Value
WAI Item 1	0.814	0.361	0.000
WAI Item 2	0.614	0.361	0.000
WAI Item 3	0.658	0.361	0.000
WAI Item 4	0.630	0.361	0.000
WAI Item 5	0.585	0.361	0.001
WAI Item 6	0.528	0.361	0.003
WAI Item 7	0.451	0.361	0.012

The final instrument assessment involved testing for multicollinearity to ensure that the individual WAI items were not highly correlated, which could have compromised the validity of the regression analysis. As shown in Table 4, the data demonstrate that all statements have a tolerance value of >0.1 and a VIF value of <10; therefore, this research instrument is free from multicollinearity.

Table 4. Multicollinearity test results.

Statement	Collinearity Statistic	
	Tolerance	VIF
Gender	0.682	1.467
Age	0.444	2.251
WAI item 1	0.290	3.451
WAI item 2	0.452	2.213
WAI item 3	0.385	2.600
WAI item 4	0.260	3.849
WAI item 5	0.268	3.725
WAI item 6	0.445	2.249
WAI item 7	0.487	2.052

Respondents' scores on each WAI item were summed to obtain a final score. The results showed that 5 respondents (5.6%) had poor work ability (score 7–27), 16 respondents (17.8%) had moderate work ability (score 28–36), 43 respondents (47.8%) had good work ability (score 37–43), and 26 respondents (28.9%) had excellent

work ability (score 44–49) (Table 5). Based on these results, most workers at the Semarang Military Base are capable of working when measured based on the WAI concept.

Table 5. Final calculation results of WAI.

Category WAI	Frequency	Percentage
Poor	5	5.6
Moderate	16	17.8
Good	43	47.8
Excellent	26	28.9
Total	90	100

The finding that the majority of personnel at the Semarang Military Base fall into the "good" Work Ability Index (WAI) category may be explained by several contributing factors. First, the military's structured and rigorous physical and mental training programs are likely to enhance individual work capacity by ensuring that personnel are physically and mentally prepared to meet occupational demands. Second, a supportive work environment and availability of adequate and well-maintained health facilities contribute to the ongoing maintenance of personnel health and well-being. Third, the strict initial selection process for military recruitment ensures that only individuals who meet the high standards of physical fitness and general health are admitted.

Both men and women had the highest percentage of good WAI categories compared to other categories. This means that there was no difference between men and women when viewed from the highest percentage of the WAI category in this study. The grouping by age is known that the age groups of 40–49 and 50–66 are the largest age groups of all respondents in this study out of the total number of respondents (73% in total), both of which are dominated by good WAI.

Using the mode calculation method, the researcher identified the most frequent scores for each WAI item to capture the dominant perceptions among respondents. Mode was preferred over mean or median because it better represented ordinal data and avoided distortion from outliers or unequal scale intervals. For Items 1 and 2, the majority of respondents gave a score of 8 on a scale of 0–10, indicating that they perceived themselves as having good work ability and considered their performance well aligned with job demands. For Item 3, the most common score was 5 on a scale of 1 to 7, suggesting that most respondents reported experiencing only one diagnosed disease. For Item 4, the mode was 6 (on a 1–6 scale), indicating that any illnesses experienced were not perceived as limiting their ability to work. For item 5, most respondents gave a score of 5, which means that the majority of respondents had never taken sick leave in the last 12 months. In item 6, most respondents gave a score of 7, which means that respondents felt confident in their ability to work for the next two years. For item 7, most respondents gave a score of 4 out of a score range of 1–4, suggesting that most respondents reported a high level of enjoyment in their current work.

Since the WAI scores did not meet the normality assumption (Shapiro-Wilk test), Spearman's rank correlation and Mann Whitney test was used to examine the association between sex and total WAI score. This non-parametric method was preferred over the independent t-test, as it does not require normally distributed data and is more appropriate for ordinal or skewed distributions. Table 6 presents the results of Spearman's rank correlation analysis examining the relationship between workers' age and their final Work Ability Index (WAI) score. The analysis showed a statistically significant result with a *p*-value of 0.002 ($p < 0.01$). The correlation coefficient was $r = -0.320$, indicating a negative relationship between age and WAI score, meaning that as personnel age increased, their WAI score tended to decrease. This decline in work ability with age can be influenced by the physically and administratively demanding nature of duties at the Semarang Military Base, which becomes increasingly challenging as personnel age. It also underscores the importance of organizational adjustments, such as modifying job tasks for older workers near retirement, and highlights the need for preventive health programs to address age-related health issues that may contribute to increased absenteeism.

Table 6. Results of the test of the relationship between ages and the final score of the WAI.

Variable	WAI			
	Statistics	*p*-Value	Description	N
Age (Spearman correlation coefficient)	−0.320	0.002	Association	90
Gender (Mann-Whitney test)	648.5	0.264	No Association	90

The Mann–Whitney U test was applied to assess differences in WAI scores between male and female personnel. This test is suitable for comparing medians between two independent groups when data is not normally distributed. The analysis showed no significant difference by sex (U = 648.5; p = 0.264). This lack of association may be related to the distinct division of tasks between male and female personnel. Male personnel are typically assigned physically demanding field duties, while female personnel handle protocols and administrative roles more often. Despite these differences in job roles, both sexes demonstrated similar distributions of WAI scores, indicating that task division may balance overall work ability levels [22].

Table 7 presents the significance level of each WAI item in relation to the total WAI score (P-value column) and their respective contribution strengths (column B). The analysis showed that five out of seven items (specifically, items 1, 2, 3, 4, and 6) significantly contributed to the final WAI score ($p < 0.05$), while items 5 (sick leave in the past year) and 7 (mental resources) did not ($p > 0.05$). Item 2, assessing the match between work ability and job demands, had the highest influence, with a regression coefficient of 0.167. This highlights the critical role of both physical and psychological demands in determining work ability, especially in military contexts, such as the Semarang Military Base, where personnel are required to sustain physical endurance and mental resilience under operational pressure.

Work physiology theory focuses on how the human body adapts to physical workloads and how this affects workers' health and performance. The work physiology theory explains how body conditions, such as muscle strength, endurance, and fitness, affect a worker's physical abilities. In contrast, WAI measures how these factors contribute to a worker's ability to remain productive in the workplace without experiencing excessive fatigue or injury [23].

Table 7. Results of multiple linear regression analysis calculations.

Items of WAI	Unadjusted Coefficients	p-Value
	B	
Item 1	0.164	0.000
Item 2	0.167	0.001
Item 3	0.151	0.000
Item 4	0.125	0.008
Item 5	0.054	0.407
Item 6	0.108	0.000
Item 7	0.060	0.432

4. Discussion

In our study, based on their WAI scores, most respondents exhibited good work abilities. This study is similar to previous research that examined whether age, gender, and type of work have a significant effect on WAI scores [5]. Our results showed that age had a negative effect on WAI (Spearman's Rho = −0.294, $p < 0.001$). Workers feel a higher workload as they get older, and it is necessary to adjust the workload, especially for workers who are older or approaching retirement, or to educate all workers about health awareness to anticipate a rapid decline in WAI.

The absence of a relationship between sex and WAI is in line with previous research that states that there is no relationship between work ability and sex [22]. Although men and women perform different duties at the Semarang Military Base, this is not sufficient to prove that there is a relationship between sex and WAI. In addition, other factors, such as worker's age, have a substantial impact on WAI outcomes.

These findings align with work physiology theories that emphasize the role of physical and mental conditions in determining work performance [14]. If WAI is used to assess a worker's ability to perform his or her job based on a variety of factors, including physical, mental, and social conditions, then occupational physiology theory focuses on how the human body adapts to physical workloads, as well as how it affects workers' health and performance [23]

The findings presented above provide valuable insights into the employability of military personnel at the Semarang Military Base. This section discusses the implications and limitations of these findings within the broader context of occupational health and military readiness.

While the WAI results among military personnel at the Semarang Military Base fall under the 'good' category, further efforts are essential to maintain and enhance work ability toward an 'excellent' level. Traditionally, state-driven health or fitness campaigns in the military context have been framed within broader national security objectives, focusing on readiness, discipline, and operational efficiency. In contrast, a Human-Centered Security (HCS) approach emphasizes the well-being of individual personnel by promoting long-term

health habits, such as regular leisure-time physical activity (LTPA), stress management, and holistic wellness, in addition to physical performance.

A comparable public health campaign can be seen in Finland's national exercise initiatives, which encourage citizens to engage in moderate-to-vigorous activity for at least 150 min per week, a recommendation echoed by Indonesia's Ministry of Health and the American Heart Association. However, what distinguishes the HCS perspective in this study is its integration of individualized and flexible physical activities, such as gardening, cycling, or climbing stairs, into the daily lives of military personnel. Unlike uniform state mandates, HCS recognize diverse physical preferences and personal well-being as critical for sustaining long-term work ability. This approach reflects a shift from compliance-based programs to empowerment-oriented strategies tailored to individual needs within the military system [24].

This study has several limitations that should be acknowledged. Data collection was conducted over a brief two-day period, which restricted the availability of personnel owing to their varying field assignments and unpredictable office presence. Consequently, the final sample size was limited, and may not fully represent the broader population of military personnel at the base. These constraints may affect the generalizability of the findings and highlight the need for caution when interpreting them. Additionally, although the intended sampling strategy was proportionate stratified sampling, the actual implementation involved accidental sampling due to limited access to personnel. This methodological adjustment may limit the generalizability of the findings.

Future studies should involve larger, more representative samples across different ranks to enhance generalizability. Longitudinal research is also needed to monitor changes in work ability over time and assess the impact of targeted interventions. Additionally, further exploration of psychosocial and organizational factors could offer a more holistic understanding of work abilities in military settings.

5. Conclusions

The study found that most personnel at the Semarang Military Base demonstrated good work ability, with job demands largely aligned with their abilities. While the current workforce generally demonstrates positive indicators, such as low sick leave and high confidence in future work capacity, the observed decline in work ability with age signals the need for proactive workforce management strategies.

Rather than focusing solely on the present conditions, these insights point to the importance of implementing continuous monitoring and targeted health promotion initiatives, particularly for aging personnel. Ensuring long-term work ability requires not only physical health interventions, but also organizational efforts to maintain a balanced workload and foster a supportive work environment. Integrating these approaches can enhance operational readiness, while supporting well-being over time.

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Conflicts of Interest

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