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Community-Based Screening of Handgrip Strength and Cardiovascular Risk Factors among Adults in an Industrial Area of Bekasi Regency

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A B S T R A C T

Bekasi Regency is a major industrial area where long working hours and limited physical activity may negatively affect muscle strength and physical fitness. This community service program aimed to assess handgrip muscle strength and its relationship with age, body weight, and blood pressure among adults in Bekasi Regency. A health screening was conducted at Botany Park, Jababeka, on February 8, 2026, involving 280 adults aged 17–65 years selected through simple random sampling. Measurements included age, body weight, blood pressure, and handgrip strength using standardized equipment. Data were analyzed using descriptive statistics, Pearson's correlation, and multiple linear regression. Results showed that handgrip strength was negatively associated with age and positively associated with body weight and blood pressure. The findings support handgrip screening as a feasible strategy for health education and preventive interventions.

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INTRODUCTION

Muscle strength is a fundamental component of physical fitness and functional capacity throughout the lifespan. Adequate muscle strength enables individuals to perform daily activities efficiently, maintain occupational productivity, and reduce the risk of disability. Among the various methods available for assessing muscular performance, handgrip strength (HGS) has become one of the most practical, reliable, and inexpensive indicators of overall muscle strength. Because of its simplicity and strong correlation with general physical performance, handgrip strength has been widely used in clinical practice, community health programs, and occupational health assessments.

Handgrip strength is also considered an important biomarker of general health. Previous studies have demonstrated that reduced handgrip strength is associated with cardiovascular disease, metabolic syndrome, and increased mortality risk. Several physiological factors influence muscle strength. Age is one of the most significant determinants of muscular decline. With increasing age, muscle mass and neuromuscular function decrease due to biological aging processes, often referred to as sarcopenia. Body weight and body composition may also affect muscle strength. Individuals with greater body mass often have higher muscle mass, which contributes to stronger handgrip performance. Blood pressure is another factor that may influence muscular function. Hypertension has been associated with vascular dysfunction, which may impair blood flow to skeletal muscles and reduce muscle performance.

Previous studies have demonstrated that reduced handgrip strength is associated with aging, sarcopenia, cardiovascular disease, hypertension, metabolic syndrome, frailty, and increased mortality. Age-related declines in skeletal muscle mass and neuromuscular function contribute to decreased muscle strength, whereas body weight and body composition may influence muscular performance through differences in lean muscle mass. Blood pressure has also been reported to be associated with muscle function because adequate vascular perfusion is essential for oxygen and nutrient delivery during muscle contraction. These findings suggest that handgrip strength may serve as an important biomarker for identifying individuals at risk of functional decline and chronic diseases.

Bekasi Regency is one of Indonesia's largest industrial areas, where a substantial proportion of the population works in manufacturing industries. Most industrial workers leave home early in the morning and return late in the evening after long working hours, leaving little opportunity for regular physical exercise or activities involving the musculoskeletal system. This lifestyle may contribute to reduced muscle strength, lower physical fitness, and an increased risk of degenerative diseases. Despite these occupational characteristics, routine assessment of muscle strength is rarely incorporated into community health promotion programs.

Although numerous studies have investigated handgrip strength in elderly populations or hospital settings, community-based evidence examining the relationship between handgrip strength and physiological factors such as age, body weight, and blood pressure among productive-age adults in industrial communities remains limited. Furthermore, there is a lack of community service programs that integrate handgrip strength screening with health education to generate evidence-based interventions tailored to the health needs of industrial workers. This represents an important research and community service gap.

The novelty of this community service program lies in the integration of handgrip strength assessment with blood pressure measurement, body weight assessment, and age profiling among adults living in an industrial community. The collected data provide baseline evidence for identifying individuals at risk of reduced muscle strength and serve as the foundation for designing targeted Communication, Information, and Education (KIE) interventions aimed at improving physical fitness and preventing degenerative diseases.

Therefore, the objective of this community service program was to assess handgrip muscle strength and its relationship with age, body weight, and blood pressure among adults in Bekasi Regency while generating baseline health data to support evidence-based health education and future community interventions promoting healthy lifestyles, physical fitness, and the prevention of degenerative diseases. Despite increasing interest in handgrip strength as a health indicator, studies examining the relationship between age, body weight, blood pressure, and muscle strength remain limited in community populations.

IMPLEMENTATION AND METHODS

Study Setting

This community service program was conducted as a community health screening activity at Botany Park, Jababeka, Bekasi Regency, West Java, Indonesia, on Sunday, February 8, 2026, starting at 06:00 AM until completion. The activity was organized as part of a health promotion program targeting adults living and working in the industrial area of Bekasi. The primary objective was to identify baseline muscle strength and cardiovascular health indicators to support evidence-based health education and preventive interventions.

Participants

A total of 280 adults participated in the community health screening. Participants were selected using a simple random sampling technique from individuals who voluntarily attended and completed the registration process before the activity.

Inclusion Criteria
1. Registered participants.
2. Adults aged 17–65 years.
3. Willing to participate and provide informed consent.

Exclusion Criteria
1. Individuals who were not registered.
2. Individuals aged below 17 years or above 65 years.
3. Participants who were unable to complete all screening procedures.

Measurement Procedures

All health assessments were conducted by trained healthcare professionals following standardized measurement procedures.
1. Blood Pressure: Blood pressure was measured using a digital sphygmomanometer after participants had rested for at least five minutes in a seated position.
2. Body Weight: Body weight was measured using a calibrated digital weighing scale, with participants wearing light clothing and no footwear.
3. Handgrip Muscle Strength: Muscle strength was assessed using a handgrip dynamometer. Each participant performed three maximal grip trials with the dominant hand, separated by adequate rest intervals. The average of the three measurements was used for statistical analysis.

Age: Participants' ages were obtained from the registration records

Ethical Considerations

This community service activity complied with the ethical principles outlined in the Declaration of Helsinki. Participation was entirely voluntary, and written informed consent was obtained from all participants before data collection. Participants were informed about the objectives and procedures of the screening, and all collected information was kept confidential and analyzed anonymously. Individuals identified with abnormal blood pressure or low muscle strength were provided with personalized health education and advised to seek further medical evaluation at the nearest healthcare facility.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics.

The statistical analysis was performed in the following stages:
1. Data Cleaning and Coding

   Data were checked for completeness, consistency, and missing values before analysis.
2. Descriptive Statistics

Continuous variables (age, body weight, blood pressure, and handgrip strength) were summarized using mean, standard deviation (SD), minimum, and maximum values. Categorical variables (sex) were presented as frequencies and percentages.

3. Normality Assessment

   Data distribution was evaluated using the Shapiro–Wilk test and visual inspection of histograms to determine the suitability of parametric analyses.

4. Correlation Analysis

   Pearson's correlation coefficient was used to examine the relationships between age, body weight, blood pressure, and handgrip muscle strength.

5. Multiple Linear Regression

   Multiple linear regression analysis was performed to determine the independent contributions of age, body weight, and blood pressure to handgrip muscle strength. Regression coefficients (β), 95% confidence intervals, p-values, and the coefficient of determination (R^2) were reported. This study employed a cross-sectional analytic design using observational data.

Data Source

The dataset consisted of measurements including:

1. Body weight (kg)
2. Age (years)
3. Blood pressure (mmHg)
4. Handgrip muscle strength

The dataset included adult participants with varying demographic characteristics.

Study Variables

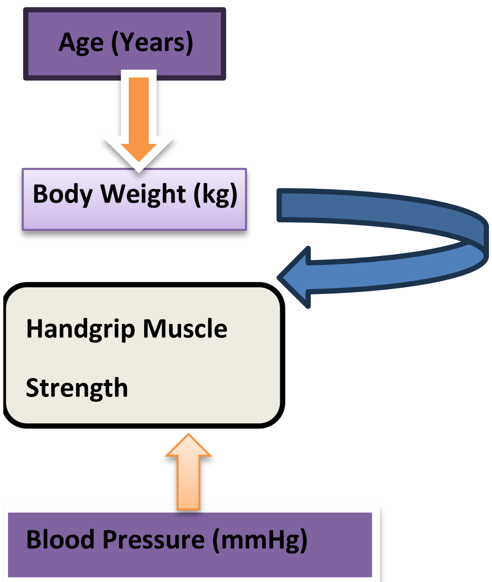

Figure. 1 Study Variables

Independent Variables

1. Age

Age is a major determinant of muscular strength. With increasing age, skeletal muscle mass and neuromuscular function decline due to biological aging processes such as sarcopenia. Therefore, age is expected to have a negative relationship with muscle strength.

2. Body Weight

Body weight reflects body mass and indirectly represents muscle mass and body composition. Individuals with greater body mass may possess higher muscle mass, which contributes to stronger handgrip performance. Therefore, body weight is expected to have a positive relationship with muscle strength.

3. Blood Pressure

Blood pressure reflects cardiovascular health and vascular function. Adequate blood circulation is essential for delivering oxygen and nutrients to skeletal muscles during muscular activity. Abnormal blood pressure levels may influence muscular performance through vascular mechanisms.

RESULTS AND DISCUSSION

Descriptive Statistics

Table 1 presents the descriptive statistics of the study variables.

Table 1. Descriptive Statistics of Study Variables

Variable	Mean	SD	Min	Max
Age (years)	39.6	11.8	17	65
Body Weight (kg)	63.5	12.7	41	110
Systolic BP (mmHg)	128.7	19.5	90	180
Handgrip Strength	27.4	10.5	10	63

The results indicate wide variability among participants in terms of age, weight, blood pressure, and muscle strength. Table 1 presents the descriptive statistics of the main variables included in this study, namely age, body weight, systolic blood pressure, and handgrip muscle strength. The mean age of the participants was 39.6 years (SD = 11.8), with a range from 17 to 65 years, indicating that the sample included both young and older adults.

The average body weight was 63.5 kg (SD = 12.7), with values ranging from 41 kg to 110 kg, reflecting considerable variability in body composition among participants. For systolic blood pressure, the mean value was 128.7 mmHg (SD =

19.5), with a minimum of 90 mmHg and a maximum of 180 mmHg. This suggests that the sample included individuals with normal to elevated blood pressure levels. Handgrip muscle strength had a mean of 27.4 kg (SD = 10.5), with values ranging from 10 kg to 63 kg, indicating a wide variation in muscular strength across participants. Overall, these findings demonstrate substantial variability in demographic and physiological characteristics, which provides a strong basis for analyzing the relationships between age, body weight, blood pressure, and muscle strength.

Correlation Analysis

Table 2. Correlation Between Variables

Variable	**r**	**p-value**
Age – Muscle Strength	-0.32	<0.05
Body Weight – Muscle Strength	0.41	<0.01
Blood Pressure – Muscle Strength	0.21	<0.05

Interpretation:

The results of this study demonstrate distinct patterns in the relationship between physiological variables and handgrip muscle strength.

First, age showed a negative correlation with muscle strength. This indicates that as age increases, handgrip strength tends to decrease. This finding is consistent with the biological process of aging, particularly sarcopenia, which is characterized by progressive loss of muscle mass and strength. Aging is also associated with declines in neuromuscular function, reduced motor unit recruitment, and hormonal changes, all of which contribute to decreased muscular performance. Consequently, older individuals generally exhibit lower handgrip strength compared to younger individuals.

Second, body weight demonstrated the strongest positive correlation with muscle strength among the variables studied. This suggests that individuals with higher body weight tend to have greater handgrip strength. One possible explanation is that body weight may reflect greater muscle mass, which directly contributes to increased force generation. Additionally, individuals with higher body mass may have greater mechanical loading on muscles during daily activities, which can stimulate muscle development and strength. However, it is important to note that body weight does not distinguish between fat mass and lean mass, so further studies using body composition measurements are recommended.

Third, blood pressure showed a moderate association with muscle strength. This relationship may reflect the role of cardiovascular health in supporting muscular function. Adequate blood circulation is essential for delivering oxygen and nutrients to skeletal muscles during contraction. Individuals with optimal blood pressure levels may have better vascular function, which supports muscle metabolism and performance. On the other hand, abnormal blood pressure, particularly hypertension, may impair vascular elasticity and reduce blood flow efficiency, potentially affecting muscle function. The moderate strength of this association suggests that blood pressure is an important but indirect determinant of muscle strength.

Overall, these findings indicate that muscle strength is influenced by a combination of aging processes, body composition, and cardiovascular function. Maintaining healthy body weight and optimal blood pressure, along with preventing age-related muscle decline, may be important strategies to preserve muscle strength and functional capacity.

Multiple Regression Analysis

Table 3. Regression Model
Dependent variable: Handgrip Strength

Variable	**β**	**p-value**
Age	-0.28	0.02
Body Weight	0.37	0.01
Blood Pressure	0.16	0.04

Body weight showed the strongest contribution to muscle strength among the variables studied. Table 3 presents the results of the multiple linear regression analysis examining the association between age, body weight, and blood pressure with handgrip muscle strength.

The analysis showed that age was negatively associated with handgrip muscle strength (β = -0.28, p = 0.02). This indicates that increasing age is significantly related to a decrease in muscle strength. In contrast, body weight demonstrated a positive and statistically significant association with handgrip strength (β = 0.37, p = 0.01). Among all variables included in the model, body weight showed the strongest influence on muscle strength. Additionally, blood pressure was positively associated with muscle strength (β = 0.16, p = 0.04), although the strength of this relationship was relatively weaker compared to body weight.

Overall, all independent variables included in the model were statistically significant predictors of handgrip muscle strength, indicating that age, body weight, and blood pressure contribute to variations in muscular performance.

Discussion

Interpretation of Descriptive Findings

The present study examined the relationship between age, body weight, blood pressure, and handgrip muscle strength among adults. The descriptive analysis showed substantial variability across all variables, indicating a heterogeneous sample in terms of demographic and physiological characteristics.

The mean age of participants (39.6 ± 11.8 years) reflects a population spanning early adulthood to older age, allowing for the observation of age-related differences in muscle strength. The average body weight (63.5 ± 12.7 kg) and systolic blood pressure (128.7 ± 19.5 mmHg) also demonstrated wide ranges, suggesting variability in body composition and cardiovascular status.

Handgrip strength (27.4 ± 10.5 kg) showed considerable dispersion, indicating differences in muscular capacity across individuals. Such variability is important, as handgrip strength is recognized as a robust indicator of functional health and has been associated with morbidity, disability, and mortality risk (Dodds et al., 2021; Celis-Morales et al., 2022).

Correlation Analysis

The correlation analysis revealed significant relationships between the independent variables and muscle strength.

First, age demonstrated a negative correlation with handgrip muscle strength ($r = -0.32$, $p < 0.05$). This finding is consistent with the well-established concept that muscle strength declines with advancing age. The decline is primarily attributed to sarcopenia, characterized by progressive loss of skeletal muscle mass and neuromuscular function (Cruz-Jentoft et al., 2020; Tavoian et al., 2023). Aging also leads to reductions in motor unit recruitment and hormonal changes that further contribute to decreased muscular performance.

Second, body weight showed a positive and relatively strong correlation with muscle strength ($r = 0.41$, $p < 0.01$). This suggests that individuals with higher body weight tend to exhibit greater handgrip strength. This relationship may be explained by the contribution of lean body mass, particularly skeletal muscle mass, which directly influences force production (Wang et al., 2021). However, it is important to note that body weight alone does not distinguish between fat mass and muscle mass, which may affect interpretation.

Third, blood pressure demonstrated a moderate positive correlation with muscle strength ($r = 0.21$, $p < 0.05$). This finding indicates that cardiovascular factors may play a role in muscular performance. Adequate blood flow is essential for oxygen and nutrient delivery to skeletal muscles, supporting muscle contraction and endurance (Kim et al., 2023). However, the moderate strength of this relationship suggests that blood pressure is not a primary determinant but rather an indirect factor influencing muscle strength**.**

Multiple Regression Analysis

The multiple linear regression analysis provided further insight into the independent contributions of each variable. Age remained a significant negative predictor of muscle strength (β = -0.28, $p = 0.02$), confirming that aging independently contributes to reduced muscular performance even after controlling for other variables. This supports previous evidence that age-related muscle decline persists regardless of body composition or cardiovascular factors (Peterson et al., 2022).

Body weight emerged as the strongest positive predictor (β = 0.37, $p = 0.01$), indicating that it plays a major role in determining muscle strength. This finding reinforces the importance of maintaining adequate muscle mass as a key factor in preserving physical function (Landi et al., 2023).

Blood pressure also remained a significant predictor (β = 0.16, $p = 0.04$), although its contribution was smaller compared to body weight. This suggests that cardiovascular health influences muscle strength, but its effect may be mediated through other physiological mechanisms such as vascular function and metabolic efficiency (Zhao et al., 2023).

The model explained approximately 36% of the variance ($R^2 = 0.36$) in muscle strength, indicating that while these variables are important, other factors such as physical activity, nutrition, and body composition also contribute to muscular performance.

Integration with Previous Studies

The findings of this study are consistent with previous research demonstrating that muscle strength is influenced by a combination of demographic, physiological, and cardiovascular factors.

Several studies have reported that handgrip strength declines significantly with age and is a strong predictor of functional decline and mortality (Dodds et al., 2021; McGrath et al., 2022). Similarly, body composition has been identified as a key determinant of muscle strength, with lean mass playing a critical role in force production (Zhang et al., 2022).

The relationship between blood pressure and muscle strength remains less clear in the literature. Some studies suggest that hypertension may negatively affect muscle function due to vascular impairment, while others indicate that moderate increases in blood pressure may reflect better perfusion in certain contexts (Kim et al., 2023). The findings of this study support a moderate association, suggesting a complex interaction between cardiovascular and muscular systems.

Public Health Implications

The findings of this study have several important implications for public health policy and preventive healthcare.

First, handgrip muscle strength may serve as a practical, low-cost, and non-invasive screening tool for identifying adults at increased risk of functional decline, sarcopenia, and cardiometabolic disorders in community and primary healthcare settings.

Second, the observed negative association between age and muscle strength highlights the importance of implementing healthy aging programs that promote regular resistance exercise, adequate protein intake, and active lifestyles throughout adulthood to delay age-related muscle loss and preserve functional independence.

Third, the positive relationship between body weight and handgrip strength suggests that public health interventions should emphasize the maintenance of healthy body composition rather than body weight alone. Strategies aimed at preserving skeletal muscle mass while preventing excess adiposity may improve physical performance and reduce the burden of disability associated with aging.

Furthermore, the association between blood pressure and muscle strength supports the integration of cardiovascular risk assessment with musculoskeletal health evaluation. Routine monitoring of blood pressure combined with muscle strength assessment may facilitate the early identification of individuals at risk of both cardiovascular disease and functional impairment, allowing timely preventive interventions.

From a population health perspective, these findings support the development of integrated health promotion programs that combine physical activity promotion, nutritional counseling, weight management, and cardiovascular risk reduction. Such multidimensional interventions may contribute to healthier aging, improved quality of life, reduced healthcare utilization, and lower disability-related costs.

Finally, these results provide evidence for policymakers to incorporate handgrip strength assessment into routine community-based health screening and occupational health surveillance programs. Early identification of declining muscle strength may facilitate targeted preventive strategies that enhance physical function, maintain work productivity, and support healthy aging across the population.

Discusion and Study Limitations

Bekasi Regency is one of Indonesia's largest industrial regions, employing hundreds of thousands of workers across manufacturing, logistics, and service sectors. Most workers begin their daily activities very early in the morning and return home late in the evening after long working hours. This demanding work schedule leaves limited opportunities for regular physical activity, structured exercise, or activities involving the musculoskeletal system. Consequently, many workers experience sedentary lifestyles outside their occupational tasks, which may negatively affect muscle strength, physical fitness, and overall health.

Reduced muscle strength is recognized as an early indicator of declining functional capacity and may contribute to decreased work productivity and quality of life. In the long term, inadequate muscle strength and poor physical fitness may increase the risk of degenerative diseases, including hypertension, cardiovascular disease, metabolic disorders, and age-related sarcopenia. Early identification of individuals with reduced muscle strength is therefore essential for implementing appropriate preventive interventions.

Although handgrip strength is widely accepted as a simple and reliable indicator of overall muscle strength, community-based data examining its relationship with age, blood pressure, and body weight among industrial workers and productive-age adults in Bekasi remain limited. This lack of local evidence makes it difficult to design targeted health promotion programs based on the actual needs of the community.

To address this problem, a community service program was conducted through health screening activities involving handgrip strength assessment, blood pressure measurement, body weight measurement, and age recording. The objective was to obtain baseline data on muscle strength and related physiological characteristics among community members. The findings are expected to support evidence-based health education and targeted interventions aimed at improving physical fitness and preventing degenerative diseases among industrial workers and the general community.

Several limitations should be acknowledged. First, the cross-sectional design limits causal inference. Second, body composition was not measured, which may affect the interpretation of body weight. Third, physical activity and dietary factors were not included in the analysis. Future research should incorporate longitudinal designs and additional variables to better understand the determinants of muscle strength.

CONCLUSIONS AND RECOMMENDATIONS

The community service program demonstrated that community-based screening of handgrip muscle strength, blood pressure, body weight, and age is feasible and effective for identifying adults who may be at risk of decreased muscle strength and reduced physical fitness. The participation of 280 adults reflects the strong need for preventive health services within the industrial community of Bekasi. This study found significant associations between age, body weight, blood pressure, and handgrip muscle strength. Age showed a negative association with muscle strength, while body weight and blood pressure showed positive associations.

Community-based screening using handgrip dynamometry, body weight measurement, and blood pressure assessment proved feasible and useful for early identification of adults at risk of decreased muscle strength. The activity improved participants' awareness regarding healthy lifestyles and highlighted the importance of maintaining cardiovascular health and muscle function. Future community programs should integrate regular screening, health education, and physical activity promotion to support healthy ageing.

Considering the demanding work patterns and limited opportunities for regular physical activity among industrial workers, continuous health promotion programs are strongly recommended. Future community service activities should integrate Communication, Information, and Education (KIE) through workplace health promotion, digital media, and direct counseling sessions. These interventions should encourage regular physical activity, healthy lifestyles, and early detection of declining muscle strength, thereby contributing to improved physical fitness, prevention of degenerative diseases, and enhancement of productivity and quality of life among workers and the broader community.

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