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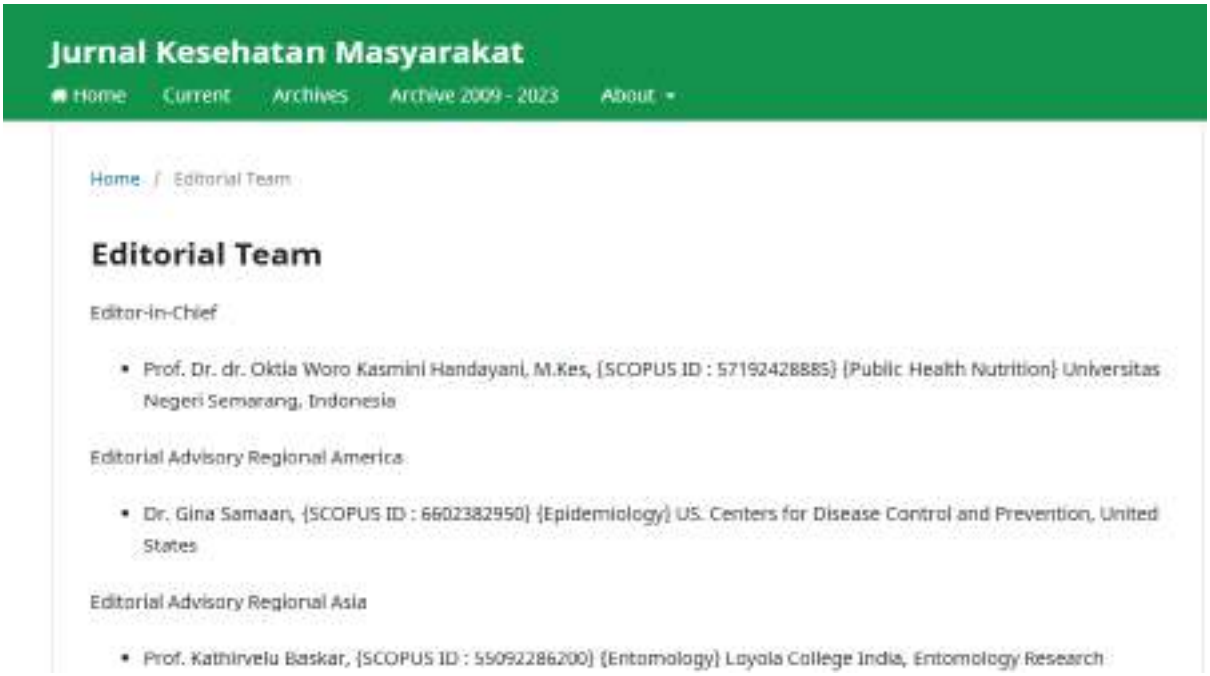

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Handgrip Strength of Public Works Personnel in West Jakarta

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Abstract

Public Works Personnel (PWP) in Jakarta perform their routine duties manually instead of using equipment. Handgrip strength (HGS) measures maximum hand strength as a quality indicator for muscle strength and mass. Factors affecting muscle strength are age, sex, body mass index (BMI), waist circumference (WC), and hip circumference (HC). Increased fasting blood glucose (FBG) is also associated with muscle quality, muscle strength, and physical performance. This study aimed to determine the factors associated with handgrip strength in PWP. A total of 192 male PWP from the Cengkareng district were recruited by simple random sampling. The collected data were demographics, BMI, FBG, WC, HC, and HGS. Statistical analysis was done using Pearson's correlation test and multiple regression analysis. There was a significant positive correlation of BMI, WC, and HC with HGS (p=0.006; r=0.20, p=0.009; r=0.19, and p=0.005; r=0.20) and a significant negative correlation between age and HGS (p=0.008; r=-0.19) but not between FBG and HGS (p=0.847). Multiple regression analysis showed height, BMI, and HC positively predicting HGS (R2=0.19). Handgrip strength of public works personnel is associated with BMI, age, waist circumference, and hip circumference, but not with fasting blood glucose. Height, BMI, and hip circumference predict handgrip strength

Introduction

Personnel for the management of public infrastructure and facilities at the village level are workers who manage village public works for a given time period on the basis of a work order. The tasks of village-level public works personnel (PWP) consist of managing the infrastructure and facilities, such as streets, drains, and parks, including installed lights (Gubernur Provinsi Daerah Khusus Ibukota Jakarta, 2017). The work performed by village PWP consists mainly of intense physical activity involving the hands, such that handgrip strength is essential in their tasks. Lowering of handgrip strength may indicate reduced muscle strength, which may especially interfere with the daily activities of village PWP that consist mainly of manual labor.

Handgrip strength measures maximal hand strength and indicates muscle quality that reflects muscle strength and mass. Muscle strength refers to the ability of muscle groups to raise a given load. Low or poor grip strength is frequently associated with damaging health impacts, such as chronic disease, and is the initial sign of reduced muscle mass, limitations in physical functions, and mortality risk. Poor handgrip strength may also reduce a person's ability to perform activities of daily living and, therefore, impact quality of life (Soraya *et al*., 2023; Nathania *et al*., 2023). Muscle mass accounts for approximately 40% of total weight, such that knowledge of muscle mass conditions is essential in maintaining health and activities (Handayani *et al*., 2018).

Handgrip strength may represent the strength of all muscles in the body. Several factors possibly influencing an individual's muscle strength are age, sex, and body mass index (BMI) (Soraya *et al*., 2023). Obesity may also affect BMI. Obesity in adults is not only associated with genetic factors but also with

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environmental factors during development (Fauzi *et al*., 2022). Handgrip strength is also associated with chronic diseases such as diabetes, metabolic syndrome, and cardiovascular disease. Increased glucose concentration is also associated with disorders of muscle quality and strength, as well as physical performance (Chen *et al*., 2023). A reduction in muscle mass also affects an individual's strength and physical endurance. A combination of proteins can maintain muscle function, thereby building body strength and physical endurance (Soenyoto *et al*., 2017). In the present study, we included fasting blood glucose concentrations in the data collection to obtain more accurate measures of glucose concentrations that have not yet been influenced by food intake.

Handgrip strength may be a health indicator that provides information on a person's health (Vaishya *et al*., 2024). However, its clinical significance in determining the prevention and treatment of poor handgrip remains limited because of the still unclear etiology of muscle weakness, especially because the clinical outcomes associated with handgrip strength are extremely diverse (McGrath *et al*., 2020). The relationship between BMI and handgrip strength is still controversial, with several investigators finding a significant positive association and others reporting a non-significant relationship (Al Asadi, 2018). There are few studies on handgrip strength, especially on workers in the sanitation sector, such as public works personnel, which is why the present investigators were interested in studying this topic. The present study aimed to determine the factors associated with handgrip strength in public works personnel.

Method

This cross-sectional study involving male public works personnel in Cengkareng District, West Jakarta, was conducted from September to October 2024. The study sample was selected by simple random sampling. Calculation of the sample size for a correlation with r=0.2, Zα=0.05, and Zβ=0.1 resulted in a sample of 192 subjects who met the inclusion criterion of being male and 25-60 years old, and the exclusion criteria of having an abnormality of the hands, heart disease, pulmonary disease, and malignancies.

Measurements were obtained on height in cm, weight in kg, as well as waist circumference and hip circumference in cm. Height and weight were determined using microtoise and digital scales, respectively. BMI was calculated using the formula of weight divided by height squared. Measurement of waist and hip circumferences was done using a measuring tape. Waist circumference was determined with the subject in the upright position, at the end of a normal expiration, at the smallest abdominal circumference between the iliac crest and twelfth rib. The cut-off values for waist circumference in males and females are ≥ 90 cm and ≥ 80 cm, respectively. Hip circumference was measured using a measuring tape that was applied around the hips at the level of the symphysis pubis and the maximal gluteal circumference (Rokhmah *et al*., 2015).

Fasting blood glucose (FBG) concentration was determined on venous blood by the hexokinase method after the respondents had fasted for approximately 10 hours prior. Handgrip strength was measured with a handgrip strength dynamometer to the nearest kilogram as follows: The respondent was asked to sit down comfortably without reclining and with the feet completely relaxed. The hips and knees were positioned at a 90^0 angle, the gripping hand with the shoulder in adduction, the elbow flexed 90^0, and the forearm and wrist in the neutral position. The gripping duration was 3 seconds. The respondent gripped the instrument with the dominant hand as hard as possible, and the value indicated by the needle was recorded. In accordance with the protocol recommended by the American Society of Hand Therapists (ASHT), the recorded handgrip strength was the average of three handgrip strength tests (Nathania *et al*., 2023).

Before data analysis by means of the correlation test, the normality of the data distribution was determined using the Kolmogorov-Smirnov test. The Pearson correlation test was used for a normal data distribution, whereas for a non-normal data distribution, the Spearman correlation test was done, followed by a multiple regression analysis. Ethics approval was issued by the Ethics Committee of the Faculty of Medicine,

Universitas Trisakti, under No. 033/KER/FK/08/2024.

Result and Discussion

In this study, the respondents comprised 192 male public works personnel of Cengkareng District who consisted of the villages (subdistricts) of Kedaung, Duri Kosambi, West Cengkareng, Kapuk, and Rawa Buaya. A total of 26% of the respondents were residents of Duri Kosambi, where Muslims comprised 98.4% of the population. The majority of the respondents, at 77.6% had an educational level of senior high school. Nearly all of the respondents, or 99%, were right-handed, using the right hand as the dominant one at work, and most were of the Betawi (Jakarta) ethnic group at 51.6% (Table 1).

Table 1. Demographic Data of the Respondents

Characteristic	**N (%)**
Village	
Kedaung	40 (20.8)
Duri Kosambi	50 (26)
Cengkareng Barat	33 (17.2)
Kapuk	43 (22.4)
Rawa Buaya	26 (13.5)
Religion	
Islamic	189 (98.4)
Christian	2 (1)
Catholic	1 (0.5)
Level of education	
Elementary school	7 (3.6)
Junior high school	29 (15.1)
Senior high school	149 (77.6)
Academy-University	7 (3.6)
Dominant hand	
Right hand	190 (99)
Left hand	2 (1)
Ethnic group	
Javanese	53 (27.6)
Betawi	99 (51.6)
Sundanese	25 (13)
Other	14 (7.3)

Legend: Other ethnicities comprised groups from Palembang, Lampung, Bima, and Kupang
Source: primary data 2024 (questionnaires and interviews with respondents)

Table 2. Respondents' Characteristics

Variable	**Mean ± SD**
Age (years)	40.9 ± 8.9
Height (cm)	164.6 ± 6.7
Weight (kg)	64.7 ± 13.1
BMI (kg/m^2)	23.8 ± 4.3
Waist circumference (cm)	85.4 ± 10.4
Hip circumference (cm)	96.9 ± 8.4

HGS (kg)	33.1 ± 6.9
FBG (mg/dL)	87 (64-280)*

Legend: BMI: body mass index. *FBG: fasting blood glucose, expressed as Median (Min-Max).
HGS: handgrip strength
Source: primary data (respondents' measurements)

Table 3. Analysis of the Relationship of Age, Height, Weight, BMI, Waist Circumference, Hip Circumference, and Fasting Blood Glucose Concentration with Handgrip Strength

Variable	R	P value
Age	- 0.19	0.008*
Height	0.36	0.000*
Weight	0.32	0.000*
BMI	0.20	0.006*
Waist circumference	0.19	0.009*
Hip circumference	0.20	0.005*
FBG	0.02	0.847#

*P value with Pearson's test, # Spearman's test
Source: primary data

Table 4. Multiple Regression Analysis on Handgrip Strength

Determinant	b	SE	p
Height	0.48	0.08	0.000
BMI	0.79	0.22	0.000
Hip circumference	- 0.29	0.12	0.015
Constant	- 36.98		

R^2=0,19
Source: primary data

The bivariate analysis found a significant positive correlation of BMI, height, weight, waist circumference, and hip circumference with handgrip strength (p=0.006, r=0.20; p=<0.001, r=0.36; p=<0.001, r=0.32; p=0.009, r=0.19; p=0.005; r=0.20, respectively). This showed that the larger the BMI, height, weight, waist circumference, and hip circumference, the stronger the handgrip. However, there was no significant relationship between fasting glucose concentration and handgrip strength (p=0.847). This study also found that age had a significant negative correlation with handgrip strength (p=0.011; r=-0.182), signifying that the older a person, the lower the handgrip strength (Table 3). Results of multiple regression analysis on handgrip strength are listed in Table 4.

This study found that most of the public works personnel in Duri Kosambi village were Muslims, had a senior high school level of education, and were of Betawi ethnicity. This was in line with the demographic data in the Cengkareng district, in that Duri Kosambi was the village with the greatest area, most of the residents were male, and the Islamic religion had the most believers (Badan Pusat Statistik Jakarta Barat, 2020). Among our respondents, more than ten percent were in the diabetes category. Socio-demographic factors capable of affecting dietary habits in patients with diabetes are the level of education and the type of family (Rondhianto *et al*., 2024). Among the respondents of this study, the dominant right hand was used for working. In the adult population, a total of 90% of the residents preferred to use the right hand for manual tasks, whereas around 10% used the left hand (Zaccagni *et al*., 2020). According to Agtuahene *et al.* (Agtuahene *et al*., 2023), the dominant hand is generally around 10% stronger than the non-dominant hand. Many activities in daily life need a high level of exertion of the muscles of the hand and forearm (Hammed *et al*., 2017). The frequent use of the dominant hand in daily living results in the muscles of the hand and forearm providing strength in gripping (Afaq *et*

al., 2019).

The mean handgrip strength in this study was 33.1 ± 6.9 kg, which is relatively low if compared with the study results of Kurniawan *et al*. (Kurniawan *et al*., 2018). In healthy young Indonesian adults, the mean handgrip strength in males was 37.37 ± 8.29 kg, and the lower limit of muscle strength in Indonesian males was 20.79 kg. The handgrip strength results in both studies are still below those of males in other Southeast Asian countries, according to the study results of Leong *et al*. (Leong *et al*., 2016). These investigators found that the mean handgrip strength in Southeast Asian males aged 35-40 years was 40 kg (34-44 kg); for the age range of 41-50 years, the handgrip strength was 38 kg (33-44 kg), for the age range of 51-60 years it was 34 kg (30-40 kg), and for ages 61-70 years 30 kg (24-34 kg). This may have been caused by ethnic differences mediated by genetic differences that also affect individual muscle strength. The highest handgrip strength is found in the European and North American populations, whereas the lowest handgrip strength is found in African, South Asian, and Southeast Asian populations. These variations in muscle strength in various countries may also be partly caused by differences in socio-economic status (Leong *et al*., 2016).

According to Agtuahene *et al*. (Agtuahene *et al*., 2023), handgrip strength is a physiological variable influenced by several factors, such as age, sex, and body measurements. In contrast, according to Zaccagni *et al*. (Zaccagni *et al*., 2020), handgrip strength, apart from being affected by age, may also be influenced by physical activity, grip measurement, height, and body mass. The present study found a significant positive correlation between BMI and handgrip strength. According to Hammed *et al*., this may be caused by the higher percentage of skeletal muscle mass compared to the percentage of fat mass, thereby resulting in a higher handgrip strength. Our study's results are identical to those of Agtuahene *et al*. (Agtuahene *et al*., 2023), who found a significant positive correlation (r=0.290) of handgrip strength with BMI and height. This shows that taller individuals with higher BMI apparently have greater handgrip strength. Our study is also in line with the study of Krakauer in 2020, which showed a positive correlation between BMI and handgrip strength (Krakauer *et al*., 2020).

The study of Cooper *et al*. (Cooper *et al*., 2022) concluded that a high childhood BMI is associated with higher grip strength at age 46 years. This is because fat mass acts as a mechanical load that elicits an anabolic response that stimulates muscle growth and function. This anabolic response is usually greater in males than in females because of the higher testosterone concentration. However, it should also be noted that BMI does not differentiate between fat mass and lean mass as adipocyte indicators that may vary with sex. It should be noted that BMI is a measure of body fat that does not differentiate between weight changes because of an increase or decrease in muscle mass or body fat (Zaccagni *et al*., 2020). According to Jafar *et al*. (Jaafar *et al*., 2023), heavier individuals have a greater muscle mass, resulting in greater handgrip strength, than lighter individuals. In the study of Heidy *et al*. (Heidy *et al*., 2019), the investigators found a positive correlation between height and forearm length. The study by Sirajudeen *et al*. (Sirajudeen *et al*., 2012) found a positive correlation between hand length and handgrip strength. This shows that height affects the longer extremity or arm, thus approaching optimal muscle length that may result in greater grip strength. According to a prospective cohort study, handgrip strength in middle age appears to be associated with birth weight and the increase in height at puberty. Pubertal growth and handgrip strength possibly represent the development of muscle size and growth (Schrager *et al*., 2007).

Our study found no relationship between blood glucose concentration and handgrip strength. Our study agrees with the study of Giglio *et al*. (Giglio *et al*., 2018), which showed no significant relationship between muscle mass strength and blood glucose concentration. According to Giglio, this is because most respondents are individuals who routinely perform structured physical activity, even though they are in the light category. This is similar to our study respondents, who were public works personnel and who had performed physical activity such as street sweeping and cleaning storm drains. Glucose is the main fuel

for muscle contraction, entering the muscle cells by diffusion through the GLUT4 glucose transporter, which, after muscle contraction, moves from its intracellular storage site to the plasma membrane and T-tubules (Richter *et al*., 2013). Glucose metabolism has an influence on handgrip strength through various mechanisms, such as disorders of glucose metabolism, particularly glycogenolysis, that may result in the loss of muscle strength. Insulin resistance in hyperglycemia may cause muscle degradation because hyperglycemia causes low muscle strength through effects on skeletal muscle mitochondria. The lowering of muscle strength by hyperglycemia occurs through Krüppel-like factor 15, which regulates skeletal muscle lipid flux. Hyperglycemia also increases pro-inflammatory cytokines, which may increase the catabolism that plays a role in the further decrease in muscle mass and quality (Gamayanti *et al*., 2023). The amount of carbohydrates also influences the glycemic response and post-prandial insulin level, impacting the supply of glycogen to the muscles (Safitri *et al*.,2020).

This study has a significant negative correlation between age and handgrip strength, which decreases with age (Manoharan *et al*., 2015). Handgrip strength initially experiences an increase with increasing age, reaches its peak between the ages of 30 and 40 years, and decreases afterward (Zaccagni *et al*., 2020). The age-related changes in skeletal muscle composition, particularly the accumulation of lipids in skeletal muscle fibers, play a role in the poor quality of the muscles and may result in metabolic abnormalities such as insulin resistance. Apart from changes in muscle quality, there is also a reduction in muscle mass that consistently occurs during aging. The increase in oxidative stress and chronic inflammation that commonly occurs in the aging process apparently also plays a role in the development of decreased muscle mass and strength (Mainous *et al*., 2015). The decrease in muscle mass in the elderly corresponds to a 10% reduction in grip strength per decade, starting from the age of 40 years (Jaafar *et al*., 2023). Skeletal muscle plays an important role in glucose metabolism and has a significant influence on insulin sensitivity. Increased insulin resistance in older adults may be closely associated with skeletal muscle aging. A reduction in GLUT4 expression as a result of a decrease in muscle volume causes a reduction in insulin sensitivity in aging skeletal muscle (Joo *et al*., 2022). The results of this study showed a correlation of waist circumference and hip circumference with handgrip strength. This is in line with the study of Widjaja *et al*. (Widjaja *et al*., 2018), who stated that there was a significant correlation of waist circumference and hip circumference with handgrip strength ($p=<0.001$, $r=0.302$; and $p=<0.001$, $r=0.296$) A greater waist circumference is associated with a greater handgrip strength in males (Hardy *et al*., 2013).

In the multiple regression analysis of HGS, we removed the data on body weight because of the occurrence of multicollinearity between weight and BMI, with a correlation coefficient of more than 0.9, indicating an extremely strong relationship between these two variables. Conceptually, only one of the variables is used in multivariate analysis. The multiple regression analysis included age, height, BMI, waist circumference, and hip circumference, with HGS as the dependent variable in a stepwise manner. After three iterations, only height, BMI, and hip circumference played a role in predicting HGS by means of the regression formula, which resulted in $R^2=0.19$. This signifies that for known values of height, BMI, and hip circumference, we can predict the HGS value 19% more accurately than without knowledge of these data. For a clinical diagnosis, a minimum increase of 10% is needed. This study found that height, BMI, and hip circumference play a role in predicting handgrip strength through the regression formula, i.e., handgrip strength = - 36.98 + 0.48 x height + 0.79 x BMI – 0.29 x hip circumference. Handgrip strength and waist circumference are surrogate muscle strength and visceral adiposity markers, respectively (Nakanishi *et al*., 2024). Waist circumference is also more sensitive in determining body fat distribution, particularly in the abdomen. Waist circumference correlates better with abdominal fat distribution than BMI (Rokhmah *et al*., 2015). Waist circumference and hip circumference are associated with obesity, in which the fat

content is higher, and the skeletal muscle and fascicular content is lower, thereby resulting in a lower contractile capacity of skeletal muscle (Afaq *et al*., 2019). The limitation of this study is that it did not evaluate other factors that may affect handgrip strength, such as nutrient intake. From the anthropometric measures of the hands and feet in this study, the causes and effects of the decrease in handgrip strength could not be determined because this study used a cross-sectional design.

Conclusion

Three factors may be used to estimate handgrip strength in PWP, namely height, BMI, and hip circumference, whereas blood glucose concentration is not correlated with handgrip strength in PWP. It is recommended to pay attention to height, BMI, and hip circumference, particularly in the acceptance criteria of PWP candidates, and to conduct further studies with consideration of other factors that affect handgrip strength, such as food intake and anthropometric features of the hands and arms.

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References

Afaq, E., Hassan, S.H., Khan, M.R., Zaidi, D.A., & Baktashi, H., 2019. Correlation of Hand Dynamometry With Body Mass Index and Waist-Hip Ratio in Medical Students. *Pak J Physiol*.,15, pp.19-21.

Agtuahene, M.A., Quartey, J., & Kwakye, S., 2023. Influence of Hand Dominance, Gender, and Body Mass Index on Hand Grip Strength. *S Afr J Physiother.*, 79, pp.1-6.

Al-Asadi, J.N., 2018. Handgrip Strength in Medical Students: Correlation with Body Mass Index and Hand Dimensions. *Asian Journal of Medical Sciences*, 9, pp.21-26.

Badan Pusat Statistik Kota Administrasi Jakarta Barat., 2020. *Kecamatan Cengkareng Dalam Angka*, pp.1-114.

Chen, D., Zhu, Y., Ni, W., Li, Y., Yin, G., Shao, Z., & Zhu, J., 2023. Hand Grip Strength is Inversely Associated with Total Daily Insulin Dose Requirement in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study. *PeerJ*., pp.1-13.

Cooper, R., Tomlinson, D., Hamer, M., & Pereira, S.M.P., 2022. Lifetime Body Mass Index and Grip Strength at Age 46 Years: The 1970 British Cohort Study. *J Cachexia Sarcopenia Muscle*, 13, pp.1-10.

Fauzi, L., Handayani, O.W.K., Susilo, M.T., Kurnia, A.R., Rahayu, S.R., Irawan, F.A., Horng Lu, F.J., Lin, C., Lai, M.F., & Yu, Y.C., 2022. Obesity in Indonesian and Taiwanese Adolescents Related to Self Perception, Diet, Exercise, and Body Image. *KEMAS*, 17(3), pp.453-461.

Gamayanti, K.A.V., Aryana, I.G.P.S., & Gotera, W., 2023. Hubungan Antara Kekuatan Genggaman Tangan Dengan Kadar Gula Darah Sewaktu Pada Lansia Di Desa Melinggih, Kecamatan Payangan, Kabupaten Gianyar. *Intisari Sains Medis*, 14(2), pp.483-488.

Giglio, B.M., Mota, J.F., Wall, B.T., & Pimentel, G.D., 2018. Low Handgrip Strength is Not Associated With Type 2 Diabetes Mellitus and Hyperglycemia: A Population-Based Study. *Clin Nutr Res*., 7(2), pp.112-116.

Hammed, A.I., & Obaseki, C.O., 2017. Interdependence of Body Mass Index with Handgrip Strength and Endurance Among Apparently Healthy Teenagers. *Turk J Kin*., 4, pp.1-7.

Handayani, M.D.N., Sadewa, A.H., Farmawati, A., & Rochmah, W., 2018. Anthropometric Prediction Equations for Estimating Muscle Mass of Elderly Women. *KEMAS*, 14(2),pp.195-204.

Hardy, R., Cooper, R., Sayer, A.A., Shlomo, Y.B., Cooper, C., Deary, I.J., Demakakos, P., Gallacher, J., Martin, R.M., McNeill, G., Starr, J.M., Steptoe, A., Syddall, H., & Kuh, D., 2013. Body Mass Index, Muscle Strength, and Physical Performance in Older Adults From Eight Cohort Studies: The Halcyon Programme. *PLoS One*, 8(2), pp.e56483.

Heidy., Djuartina, T., & Irawan, R., 2019. Korelasi Kekuatan Genggaman Tangan Dengan Karakter Antropometri Lengan Bawah dan Tangan Serta Indeks Massa Tubuh. *Damianus Journal of Medicine*,18, pp.1-7.

Ilmi, A.F., & Utari, D.M., 2020. Hubungan Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul (RLPP) Terhadap Kadar Glukosa Darah Puasa Pada Mahasiswa. *Journal of Nutrition College*, 9, pp.222-227.

Jaafar, M.H., Ismail, R., Ismail, N.H., Isa, Z.M., Tamil, A.M., Nasir, N.M., Keat, N.K., Razak, N.H., Abidin, N.Z., & Yusof, K.H., 2023. Normative Reference Values and Predicting Factors of Handgrip Strength For Dominant

and Non-Dominant Hands Among Healthy Malay Adults in Malaysia. *BMC Musculoskelet Disord*., 24, pp.1-9.

Joo, K.C., Son, D.H., & Park, J.M., 2022. Association Between Relative Handgrip Strength and Insulin Resistance in Korean Elderly Men Without Diabetes: Findings Of The 2015 Korea National Health Nutrition Examination Survey. *Korean J Fam Med*., 43, pp.199-205.

Krakauer, N.Y., & Krakauer, J.C., 2020. Association of Body Shape Index (ABSI) with Hand Grip Strength. *Int J Environ Res Public Health*,17, pp.1-12.

Kurniawan, A., Widjaja, D., & Lugito, N.P.H., 2018. *Mean and Cutoff Value of Hand Grip Strength For Healthy Indonesian Young Adults*. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.

Leong, D.P., Teo, K.K., Rangarajan, S., Kutty, R., Lanas, F., Hui, C., Quanyong, X., Zhenzhen, Q., Jinhua, T., Noorhassim, I., AlHabib, K.F., Moss, S.J., Rosengren, A., Akalin, A.A., Rahman, O., Chifamba, J., Orlandini, A., Kumar, R., Yeates, K., Gupta, R., Yusufali, A., Dans, A., Avezum, A., Lopez-Jaramillo, P., Poirier, P., Heidari, H., Zatonska, K., Iqbal, R., Khatib, R., & Yusuf, S., 2016. Reference Ranges of Handgrip Strength From 125,462 Healthy Adults in 21 Countries: A Prospective Urban Rural Epidemiologic (PURE) Study. *J Cachexia Sarcopenia Muscle*,7, pp.535-546.

Mainous, A.G., Tanner, R.J., Anton, S.D., & Jo, A., 2015. Grip Strength as A Marker of Hypertension and Diabetes in Healthy Weight Adults. *Am J Prev Med*, 49(6), pp.850-858.

Manoharan, V.S., Sundaram, S.G., & Jason, J.I., 2015. Factors Affecting Hand Grip Strength and Its Evaluation: A Systemic Review. *Int J Physiother Res*., 3(6), pp.1288-1293.

McGrath, R., Johnson, N., Klawitter, L., Mahoney, S., Trautman, K., Carlson, C., Rockstad, E., & Hackney, K.J., 2020. What Are The Association Patterns Between Handgrip Strength and Adverse Health Conditions? A Topical Review. *SAGE Open Medicine*, 8, pp.1-12.

Nakanishi, S., Shimoda, M., Kimura, T., Sanada, J., Fushimi, Y., Iwamoto, Y., Iwamoto, H., Dan, K., Mune, T., Kaku, K., & Kaneto, H., 2024. The Impact of Handgrip Strength and Waist Circumference on Glycemic Control: Prospective, Observational Study Using Outpatient Clinical Data in Japanese Patients With Type 2 Diabetes Mellitus. *J Diabetes Investig*., 15(7), pp.892-898.

Nathania, N.P.S., Nugraha, M.H.S., Primayanti, I.D.A., & Saraswati, P.A.S., 2023. Handgrip Strength is Associated With Balance in Elderly Women. *Majalah Ilmiah Fisioterapi Indonesia*, 11, pp.70-75.

Gubernur Provinsi Daerah Khusus Ibukota Jakarta., 2017. *Peraturan Gubernur Provinsi Daerah Khusus Ibukota Jakarta Nomor 7 tahun 2017 Tentang Penanganan Prasarana dan Sarana Umum Tingkat Kelurahan*. Jakarta 2017.

Richter, E.A., & Hargreaves, M., 2013. Exercise, GLUT4, and Skeletal Muscle Glucose Uptake. *Physiol Rev*., 93(3), pp.993-1017.

Rokhmah, F.D., Handayani, D., & Al-Rasyid, H., 2015. Korelasi Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul Terhadap Kadar Glukosa Plasma Menggunakan Tes Toleransi Glukosa Oral. Jurnal Gizi Klinik Indonesia,12, pp.28-35.

Rondhianto., Ridla, A.Z., & Hasan, H., 2024. Sociodemographic Factors Affecting Diabetic Dietary Behavior in People with Type 2 Diabetes Mellitus. *KEMAS*, 19(3), pp.429-437.

Safitri, I., Setyarsih, L., Susanto, H., Suhartono., & Fitranti, D.Y., 2020. The Effect of Low and High Glycemic Load Diet on Muscle Fatigue of Young Soccer Athletes. *KEMAS*, 16(1), pp.111-120.

Schrager, M.A., Metter, E.J., Simonsick, E., Ble, A., Bandinelli, S., Lauretani, F., & Ferrucci, L., 2007. Sarcopenic Obesity and Inflammation in The Inchianti Study. *J Appl Physiol*., 102(3), pp.919-925.

Sirajudeen, M.S., Shah, U.N., Pillai, P.S., Mohasin, N., & Shantaram, M., 2012. Correlation Between Grip Strength and Physical Factors in Men. *International Journal of Health and Rehabilitation Sciences*, 1, pp.58-63.

Soenyoto, T., Mollap, K., & Mungpong, J., 2017. Correlation of Energy and Protein Consumption Levels with Physical Endurance of Rhythmic Gymnast Athletes. *KEMAS*, 13(1), pp.131-136.

Soraya, N., & Parwanto, E., 2023. The Controversial Relationship Between Body Mass Index and Handgrip Strength in The Elderly: An Overview. *Malays J Med Sci*., 30, pp.73-83.

Vaishya, R., Misra, A., Vaish, A., Ursino, N., & D'Ambrosi, R., 2024. Hand Grip Strength as A Proposed New Vital Sign Of Health: A Narrative Review of Evidences. *Journal of Health, Population and Nutrition*, 43, pp.1-

14.
Widjaja, D., Tjhai, K., Dermawan, K., Kalim, J., Tanzil, S., Pramusinta, A., Phenca, H.K., Kurniawan, A., 2018. *Correlations Between Hand Grip Strength and Anthropometric Status in Young Indonesian Adults*. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.
Zaccagni, L., Toselli, S., Bramanti, B., Gualdi-Russo, E., Mongillo, J., & Rinaldo, N., 2020. Handgrip Strength in Young Adults: Association With Anthropometric Variables and Laterality. *Int J Environ Res Public Health*, 17, pp.1-18.

Handgrip strength of public works personnel in West Jakarta

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Handgrip Strength of Public Works Personnel in West Jakarta

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Handgrip strength; Body mass index; Hip circumference; Waist circumference; Fasting blood glucose

Abstract

Public Works Personnel (PWP) in Jakarta perform their routine duties manually instead of using equipment. Handgrip strength (HGS) measures maximum hand strength as a quality indicator for muscle strength and mass. Factors affecting muscle strength are age, sex, body mass index (BMI), waist circumference (WC), and hip circumference (HC). Increased fasting blood glucose (FBG) is also associated with muscle quality, muscle strength, and physical performance. This study aimed to determine the factors associated with handgrip strength in PWP. A total of 192 male PWP from the Cengkareng district were recruited by simple random sampling. The collected data on demographics, BMI, FBG, WC, HC, and HGS. Statistical analysis was done using Pearson's correlation test and multiple regression analysis. There was a significant positive correlation of BMI, WC, and HC with HGS ($p=0.004$; $r=0.20$, $p=0.909$; $r=0.19$, and $p=0.005$; $r=0.20$) and a significant negative correlation between age and HGS ($p=0.008$, $r=-0.19$) but not between FBG and HGS ($p=0.847$). Multiple regression analysis showed height, BMI, and HC positively predicting HGS ($R2=0.19$). Handgrip strength of public works personnel is associated with BMI, age, waist circumference, and hip circumference, but not with fasting blood glucose. Height, BMI, and hip circumference predict handgrip strength.

Introduction

Personnel for the management of public infrastructure and facilities at the village level are workers who manage village public works for a given time period on the basis of a work order. The tasks of village-level public works personnel (PWP) consist of managing the infrastructure and facilities, such as streets, drains, and parks, including installed lights (Gubernur Provinsi Daerah Khusus Ibukota Jakarta, 2017). The work performed by village PWP consists mainly of intense physical activity involving the hands, such that handgrip strength is essential in their tasks. Lowering of handgrip strength may indicate reduced muscle strength, which may especially interfere with the daily activities of village PWP that consist mainly of manual labor.

Handgrip strength measures maximal hand strength and indicates muscle quality that reflects muscle strength and mass. Muscle strength refers to the ability of muscle groups to raise a given load. Low or poor grip strength is frequently associated with damaging health impacts, such as chronic disease, and is the initial sign of reduced muscle mass, limitations in physical functions, and mortality risk. Poor handgrip strength may also reduce a person's ability to perform activities of daily living and, therefore, impact quality of life (Soraya *et al.*, 2023; Nathania *et al.*, 2023). Muscle mass accounts for approximately 40% of total weight, such that knowledge of muscle mass conditions is essential in maintaining health and activities (Handayani *et al.*, 2018).

Handgrip strength may represent the strength of all muscles in the body. Several factors possibly influencing an individual's muscle strength are age, sex, and body mass index (BMI) (Soraya *et al.*, 2023). Obesity may also affect BMI. Obesity in adults is not only associated with genetic factors but also with

environmental factors during development (Inzi *et al.*, 2022). Handgrip strength is also associated with chronic diseases such as diabetes, metabolic syndrome, and cardiovascular disease. Increased glucose concentration is also associated with disorders of muscle quality and strength, as well as physical performance (Chen *et al.*, 2023). A reduction in muscle mass also affects an individual's strength and physical endurance. A combination of proteins can maintain muscle function, thereby building body strength and physical endurance (Soenyoto *et al.*, 2017). In the present study, we included fasting blood glucose concentrations in the data collection to obtain more accurate measures of glucose concentrations that have not yet been influenced by food intake.

Handgrip strength may be a health indicator that provides information on a person's health (Vaishya *et al.*, 2024). However, its clinical significance in determining the prevention and treatment of poor handgrip remains limited because of the still unclear etiology of muscle weakness, especially because the clinical outcomes associated with handgrip strength are extremely diverse (McGrath *et al.*, 2020). The relationship between BMI and handgrip strength is still controversial, with several investigators finding a significant positive association and others reporting a non-significant relationship (Al Asadi, 2018). There are few studies on handgrip strength, especially on workers in the sanitation sector, such as public works personnel, which is why the present investigators were interested in studying this topic. The present study aimed to determine the factors associated with handgrip strength in public works personnel.

Method

This cross-sectional study involving male public works personnel in Cengkareng District, West Jakarta, was conducted from September to October 2024. The study sample was selected by simple random sampling. Calculation of the sample size for a correlation with r=0.2, Zα=0.05, and Zβ=0.1 resulted in a sample of 192 subjects who met the inclusion criterion of being male and 25-60 years old, and the exclusion criteria of having an abnormality of the hands, heart disease, pulmonary disease, and malignancies.

Measurements were obtained on height in cm, weight in kg, as well as waist circumference and hip circumference in cm. Height and weight were determined using microtoise and digital scales, respectively. BMI was calculated using the formula of weight divided by height squared. Measurement of waist and hip circumferences was done using a measuring tape. Waist circumference was determined with the subject in the upright position, at the end of a normal expiration, at the smallest abdominal circumference between the iliac crest and twelfth rib. The cut-off values for waist circumference in males and females are ≥ 90 cm and ≥ 80 cm, respectively. Hip circumference was measured using a measuring tape that was applied around the hips at the level of the symphysis pubis and the maximal gluteal circumference (Rokhmah *et al.*, 2015).

Fasting blood glucose (FBG) concentration was determined on venous blood by the hexokinase method after the respondents had fasted for approximately 10 hours prior. Handgrip strength was measured with a handgrip strength dynamometer to the nearest kilogram as follows: The respondent was asked to sit down comfortably without reclining and with the feet completely relaxed. The hips and knees were positioned at a 90° angle, the gripping hand with the shoulder in adduction, the elbow flexed 90°, and the forearm and wrist in the neutral position. The gripping duration was 3 seconds. The respondent gripped the instrument with the dominant hand as hard as possible, and the value indicated by the needle was recorded. In accordance with the protocol recommended by the American Society of Hand Therapists (ASHT), the recorded handgrip strength was the average of three handgrip strength tests (Nathania *et al.*, 2023).

Before data analysis by means of the correlation test, the normality of the data distribution was determined using the Kolmogorov-Smirnov test. The Pearson correlation test was used for a normal data distribution, whereas for a non-normal data distribution, the Spearman correlation test was done, followed by a multiple regression analysis. Ethics approval was issued by the Ethics Committee of the Faculty of Medicine,

Universitas Trisakti, under No. 03/KEK/FK/08/2024.

Result and Discussion

In this study, the respondents comprised 192 male public works personnel of Cengkareng District who consisted of the villages (subdistricts) of Kedaung, Duri Kosambi, West Cengkareng, Kapuk, and Rawa Buaya. A total of 26% of the respondents were residents of Duri Kosambi, where Muslims comprised 98.4% of the population. The majority of the respondents, at 77.6% had an educational level of senior high school. Nearly all of the respondents, or 99%, were right-handed, using the right hand as the dominant one at work, and most were of the Betawi (Jakarta) ethnic group at 51.6% (Table 1).

Table 1. Demographic Data of the Respondents

Characteristic	N (%)
Village	
Kedaung	40 (20.8)
Duri Kosambi	50 (26)
Cengkareng Barat	33 (17.2)
Kapuk	43 (22.4)
Rawa Buaya	26 (13.5)
Religion	
Islamic	189 (98.4)
Christian	2 (1)
Catholic	1 (0.5)
Level of education	
Elementary school	7 (3.6)
Junior high school	29 (15.1)
Senior high school	149 (77.6)
Academy/University	7 (3.6)
Dominant hand	
Right hand	190 (99)
Left hand	2 (1)
Ethnic group	
Javanese	53 (27.6)
Betawi	99 (51.6)
Sundanese	25 (13)
Other	14 (7.3)

Legend: Other ethnicities comprised groups from Palembang, Lampung, Batak, and Kapuas
Source: primary data 2024 (questionnaires and interviews with respondents)

Table 2. Respondents' Characteristics

Variable	Mean ± SD
Age (years)	40.9 ± 8.9
Height (cm)	164.6 ± 6.7
Weight (kg)	64.7 ± 13.1
BMI (kg/m²)	23.8 ± 4.2
Waist circumference (cm)	83.4 ± 10.4
Hip circumference (cm)	96.9 ± 8.4

HGS (kg)	33.1 ± 6.9
FBG (mg/dL)	87 (64–280)*

Legend: BMI: body mass index. *FBG: fasting blood glucose, expressed as Median (Min–Max).
HGS: handgrip strength.
Source: primary data (respondents' measurements)

Table 3. Analysis of the Relationship of Age, Height, Weight, BMI, Waist Circumference, Hip Circumference, and Fasting Blood Glucose Concentration with Handgrip Strength

Variable	R	P value
Age	- 0.19	0.038*
Height	0.36	0.000*
Weight	0.32	0.000*
BMI	0.20	0.030*
Waist circumference	0.19	0.009*
Hip circumference	0.20	0.005*
FBG	0.02	0.847*

*P value with Pearson's test, *Spearman's test
Source: primary data

Table 4. Multiple Regression Analysis on Handgrip Strength

Determinant	b	SE	p
Height	0.48	0.08	0.000
BMI	0.78	0.22	0.000
Hip circumference	- 0.29	0.12	0.015
Constant	- 36.88		

R^2=0.19
Source: primary data

The bivariate analysis found a significant positive correlation of BMI, height, weight, waist circumference, and hip circumference with handgrip strength (p=0.006, r=0.20; p=<0.001, r=0.36; p=<0.001, r=0.32; p=0.009, r=0.19; p=0.005; r=0.20, respectively). This showed that the larger the BMI, height, weight, waist circumference, and hip circumference, the stronger the handgrip. However, there was no significant relationship between fasting glucose concentration and handgrip strength (p=0.847). This study also found that age had a significant negative correlation with handgrip strength (p=0.011; r=−0.182), signifying that the older a person, the lower the handgrip strength (Table 3). Results of multiple regression analysis on handgrip strengths are listed in Table 4.

This study found that most of the public works personnel in Duri Kosambi village were Muslims, had a senior high school level of education, and were of Betawi ethnicity. This was in line with the demographic data in the Cengkareng district, in that Duri Kosambi was the village with the greatest area, most of the residents were male, and the Islamic religion had the most believers (Badan Pusat Statistik Jakarta Barat, 2020). Among our respondents, more than ten percent were in the diabetes category. Socio-demographic factors capable of affecting dietary habits in patients with diabetes are the level of education and the type of family (Roodhianto *et al.*, 2024). Among the respondents of this study, the dominant right hand was used for working. In the adult population, a total of 90% of the residents preferred to use the right hand for manual tasks, whereas around 10% used the left hand (Zaccagni *et al.*, 2020). According Agtasbene *et al.* (Agtasbene *et al.*, 2023), the dominant hand is generally around 10% stronger than the non-dominant hand. Many activities in daily life need a high level of exertion of the muscles of the hand and forearm (Hammod *et al.*, 2017). The frequent use of the dominant hand in daily living results in the muscles of the hand and forearm providing strength in gripping (Afaq *et*

al., 2019).

The mean handgrip strength in this study was 33.1 ± 6.9 kg, which is relatively low if compared with the study results of Kurniawan *et al.* (Kurniawan *et al.*, 2018). In healthy young Indonesian adults, the mean handgrip strength in males was 37.37 ± 8.29 kg, and the lower limit of muscle strength in Indonesian males was 20.79 kg. The handgrip strength results in both studies are still below those of males in other Southeast Asian countries, according to the study results of Leong *et al.* (Leong *et al.*, 2016). These investigators found that the mean handgrip strength in Southeast Asian males aged 35-40 years was 40 kg (34-44 kg); for the age range of 41-50 years, the handgrip strength was 38 kg (33-44 kg), for the age range of 51-60 years it was 34 kg (30-40 kg), and for ages 61-70 years 30 kg (24-34 kg). This may have been caused by ethnic differences mediated by genetic differences that also affect individual muscle strength. The highest handgrip strength is found in the European and North American populations, whereas the lowest handgrip strength is found in African, South Asian, and Southeast Asian populations. These variations in muscle strength in various countries may also be partly caused by differences in socio-economic status (Leong *et al.*, 2016).

According to Agnuahene *et al.* (Agnuahene *et al.*, 2023), handgrip strength is a physiological variable influenced by several factors, such as age, sex, and body measurements. In contrast, according to Zaccagni *et al.* (Zaccagni *et al.*, 2020), handgrip strength, apart from being affected by age, may also be influenced by physical activity, grip measurement, height, and body mass. The present study found a significant positive correlation between BMI and handgrip strength. According to Hammed *et al.*, this may be caused by the higher percentage of skeletal muscle mass compared to the percentage of fat mass, thereby resulting in a higher handgrip strength. Our study's results are identical to those of Agnuahene *et al.* (Agnuahene *et al.*, 2023), who found a significant positive correlation (r=0.290) of handgrip strength with BMI and height. This shows that taller individuals with higher BMI apparently have greater handgrip strength. Our study is also in line with the study of Krakauer in 2020, which showed a positive correlation between BMI and handgrip strength (Krakauer *et al.*, 2020).

The study of Cooper *et al.* (Cooper *et al.*, 2022) concluded that a high childhood BMI is associated with higher grip strength at age 46 years. This is because fat mass acts as a mechanical load that elicits an anabolic response that stimulates muscle growth and function. This anabolic response is usually greater in males than in females because of the higher testosterone concentration. However, it should also be noted that BMI does not differentiate between fat mass and lean mass as adipocyte indicators that may vary with sex. It should be noted that BMI is a measure of body fat that does not differentiate between weight changes because of an increase or decrease in muscle mass or body fat (Zaccagni *et al.*, 2020). According to Jafar *et al.* (Jaafar *et al.*, 2023), heavier individuals have a greater muscle mass, resulting in greater handgrip strength, than lighter individuals. In the study of Heidy *et al.* (Heidy *et al.*, 2019), the investigators found a positive correlation between height and forearm length. The study by Sirajudeen *et al.* (Sirajudeen *et al.*, 2012) found a positive correlation between hand length and handgrip strength. This shows that height affects the longer extremity or arm, thus approaching optimal muscle length that may result in greater grip strength. According to a prospective cohort study, handgrip strength in middle age appears to be associated with birth weight and the increase in height at puberty. Pubertal growth and handgrip strength possibly represent the development of muscle size and growth (Schrager *et al.*, 2007).

Our study found no relationship between blood glucose concentration and handgrip strength. Our study agrees with the study of Giglio *et al.* (Giglio *et al.*, 2018), which showed no significant relationship between muscle mass strength and blood glucose concentration. According to Giglio, this is because most respondents are individuals who routinely perform structured physical activity, even though they are in the light category. This is similar to our study respondents, who were public works personnel and who had performed physical activity such as street sweeping and cleaning storm drains. Glucose is the main fuel

for muscle contraction, entering the muscle cells by diffusion through the GLUT4 glucose transporter, which, after muscle contraction, moves from its intracellular storage site to the plasma membrane and T-tubules (Richter *et al.*, 2013). Glucose metabolism has an influence on handgrip strength through various mechanisms, such as disorders of glucose metabolism, particularly glycogenolysis, that may result in the loss of muscle strength. Insulin resistance in hyperglycemia may cause muscle degradation because hyperglycemia causes low muscle strength through effects on skeletal muscle mitochondria. The lowering of muscle strength by hyperglycemia occurs through Krüppel-like factor 15, which regulates skeletal muscle lipid flux. Hyperglycemia also increases pro-inflammatory cytokines, which may increase the catabolism that plays a role in the further decrease in muscle mass and quality (Gamayanti *et al.*, 2023). The amount of carbohydrates also influences the glycemic response and post-prandial insulin level, impacting the supply of glycogen to the muscles (Safitri *et al.*, 2020).

This study has a significant negative correlation between age and handgrip strength, which decreases with age (Manoharan *et al.*, 2015). Handgrip strength initially experiences an increase with increasing age, reaches its peak between the ages of 30 and 40 years, and decreases afterward (Zaccagni *et al.*, 2020). The age-related changes in skeletal muscle composition, particularly the accumulation of lipids in skeletal muscle fibers, play a role in the poor quality of the muscles and may result in metabolic abnormalities such as insulin resistance. Apart from changes in muscle quality, there is also a reduction in muscle mass that consistently occurs during aging. The increase in oxidative stress and chronic inflammation that commonly occurs in the aging process apparently also plays a role in the development of decreased muscle mass and strength (Mainous *et al.*, 2015). The decrease in muscle mass in the elderly corresponds to a 10% reduction in grip strength per decade, starting from the age of 40 years (Jaafar *et al.*, 2023). Skeletal muscle plays an important role in glucose metabolism and has a significant influence on insulin sensitivity. Increased insulin resistance in older adults may be closely associated with skeletal muscle aging. A reduction in GLUT4 expression as a result of a decrease in muscle volume causes a reduction in insulin sensitivity in aging skeletal muscle (Joo *et al.*, 2022). The results of this study showed a correlation of waist circumference and hip circumference with handgrip strength. This is in line with the study of Widjaja *et al.* (Widjaja *et al.*, 2018), who stated that there was a significant correlation of waist circumference, hip circumference with handgrip strength ($p<0.001$, $r=0.302$; and $p<0.001$, $r=0.296$). A greater waist circumference is associated with a greater handgrip strength in males (Hardy *et al.*, 2013).

In the multiple regression analysis of HGS, we removed the data on body weight because of the occurrence of multicollinearity between weight and BMI, with a correlation coefficient of more than 0.9, indicating an extremely strong relationship between these two variables. Conceptually, only one of the variables is used in multivariate analysis. The multiple regression analysis included age, height, BMI, waist circumference, and hip circumference, with HGS as the dependent variable in a stepwise manner. After three iterations, only height, BMI, and hip circumference played a role in predicting HGS by means of the regression formula, which resulted in $R^2=0.19$. This signifies that for known values of height, BMI, and hip circumference, we can predict the HGS value 19% more accurately than without knowledge of these data. For a clinical diagnosis, a minimum increase of 10% is needed. This study found that height, BMI, and hip circumference play a role in predicting handgrip strength through the regression formula, i.e., handgrip strength = − 36.98 + 0.48 x height + 0.79 x BMI − 0.29 x hip circumference. Handgrip strength and waist circumference are surrogate muscle strength and visceral adiposity markers, respectively (Nakanishi *et al.*, 2024). Waist circumference is also more sensitive in determining body fat distribution, particularly in the abdomen. Waist circumference correlates better with abdominal fat distribution than BMI (Rokhmah *et al.*, 2015). Waist circumference and hip circumference are associated with obesity, in which the fat

content is higher, and the skeletal muscle and fascicular content is lower, thereby resulting in a lower contractile capacity of skeletal muscle (Afaq et al., 2019). The limitation of this study is that it did not evaluate other factors that may affect handgrip strength, such as nutrient intake. From the anthropometric measures of the hands and feet in this study, the causes and effects of the decrease in handgrip strength could not be determined because this study used a cross-sectional design.

Conclusion

Three factors may be used to estimate handgrip strength in PWP, namely height, BMI, and hip circumference, whereas blood glucose concentration is not correlated with handgrip strength in PWP. It is recommended to pay attention to height, BMI, and hip circumference, particularly in the acceptance criteria of PWP candidates, and to conduct further studies with consideration of other factors that affect handgrip strength, such as food intake and anthropometric features of the hands and arms.

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References

Afaq, E., Hassan, S.H., Khan, M.R., Zaidi, D.A., & Baktashi, H., 2019. Correlation of Hand Dynamometry With Body Mass Index and Waist-Hip Ratio in Medical Students. *Pak J Physiol.*,15, pp.19-21.

Agtuahene, M.A., Quartey, J., & Kwakye, S., 2023. Influence of Hand Dominance, Gender, and Body Mass Index on Hand Grip Strength. *S Afr J Physiother.*, 79, pp.1-6.

Al-Asadi, J.N., 2018. Handgrip Strength in Medical Students: Correlation with Body Mass Index and Hand Dimensions. *Asian Journal of Medical Sciences*, 9, pp.21-26.

Badan Pusat Statistik Kota Administrasi Jakarta Barat., 2020. *Kecamatan Grogol petamburan Dalam Angka*, pp.1-114.

Chen, D., Zhu, Y., Ni, W., Li, Y., Yin, G., Shao, Z., & Zhu, L. 2023. Hand Grip Strength is Inversely Associated with Total Daily Insulin Dose Requirement in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study. *PeerJ.*, pp.1-13.

Cooper, R., Tomlinson, D., Hamer, M., & Pereira, S.M.P., 2022. Lifetime Body Mass Index and Grip Strength at Age 46 Years: The 1970 British Cohort Study. *J Cachexia Sarcopenia Muscle*, 13, pp.1-10.

Fauzi, L., Handayani, O.W.K., Susilo, M.T., Kurnia, A.R., Baharya, S.R., Irawan, F.A., Hsing Lu, F.J., Liu, C., Lai, M.F., & Yu, Y.C., 2022. Obesity in Indonesian and Taiwanese Adolescents Related to Self Perception, Diet, Exercise, and Body Image. *KEMAS*, 17(3), pp.453-461.

Gamayanti, K.A.V., Aryana, I.G.P.S., & Gotera, W., 2015. Hubungan Antara Kekuatan Genggaman Tangan Dengan Kadar Gula Darah Sewaktu Pada Lansia Di Desa Melinggih, Kecamatan Payangan, Kabupaten Gianyar. *Intisari Sains Medis*, 14(2), pp.483-488.

Giglio, B.M., Maria, I.F., Wall, B.T., & Pimentel, G.D., 2018. Low Handgrip Strength is Not Associated With Type 2 Diabetes Mellitus and Hyperglycemia: A Population-Based Study. *Clin Nutr Res.*, 7(2), pp.112-116.

Hammed, A.J., & Obaseki, C.O., 2017. Interdependence of Body Mass Index with Handgrip Strength and Endurance Among Apparently Healthy Teenagers. *TurA J Kin.*, 4, pp.1-7.

Handayani, M.D.N., Sadewa, A.H., Furmaneki, A., & Rochmah, W., 2018. Anthropometric Prediction Equations for Estimating Muscle Mass of Elderly Women. *KEMAS*, 14(2),pp.193-204.

Hardy, R., Cooper, R., Sayer, A.A., Shiroma, Y.B., Cooper, C., Deary, I.J., Demakakos, P., Gallacher, J., Martin, R.M., McNeill, G., Starr, J.M., Stephan, A., Syddall, H., & Kuh, D., 2013. Body Mass Index, Muscle Strength, and Physical Performance in Older Adults From Eight Cohort Studies: The Halcyon Programme. *PLoS One*, 8(2), pp.e56483.

Heidy, Djuartina, T., & Irawan, R., 2019. Korelasi Kekuatan Genggaman Tangan Dengan Karakter Antropometri Lengan Bawah dan Tangan Serta Indeks Massa Tubuh. *Damianus Journal of Medicine*,18, pp.1-7.

Ilmi, A.F., & Utari, D.M., 2020. Hubungan Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul (RLPP) Terhadap Kadar Glukosa Darah Puasa Pada Mahasiswa. *Journal of Nutrition College*, 9, pp.222-227.

Jaafar, M.H., Ismail, R., Ismail, N.H., Isa, Z.M., Tamil, A.M., Nasir, N.M., Krut, N.K., Razak, N.H., Abidin, N.Z., & Yusof, K.H., 2023. Normative Reference Values and Predicting Factors of Handgrip Strength For Dominant

and Non-Dominant Hands Among Healthy Malay Adults in Malaysia. *BMC Musculoskelet Disord*., 24. pp.1-9.

Joo, K.C., Son, D.H., & Park, J.M., 2022. Association Between Relative Handgrip Strength and Insulin Resistance in Korean Elderly Men Without Diabetes: Findings Of The 2015 Korea National Health Nutrition Examination Survey. *Korean J Fam Med*., 43, pp.199-205.

Krakauer, N.Y., & Krakauer, J.C., 2020. Association of Body Shape Index (ABSI) with Hand Grip Strength. *Int J Environ Res Public Health*.17, pp.1-12.

Kurniawan, A., Widjaja, D., & Lugito, N.P.H., 2018. *Mean and Cutoff Value of Hand Grip Strength For Healthy Indonesian Young Adults*. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases: Krakow, Poland.

Leong, D.P., Teo, K.K., Rangarajan, S., Kutty, R., Lanas, F., Hui, C., Quanyong, X., Zhenzhen, Q., Jinhua, T., Noorhassim, I., AlHabib, K.F., Mony, S.J., Rosengren, A., Akalin, A.A., Rahman, O., Chifamba, J., Orlandini, A., Kumar, R., Yeates, K., Gupta, R., Yusufali, A., Dans, A., Avezum, A., Lopez-Jaramillo, P., Poirier, P., Heidari, H., Zatonska, K., Iqbal, R., Khatib, R., & Yusuf, S., 2016. Reference Ranges of Handgrip Strength From 125,462 Healthy Adults in 21 Countries: A Prospective Urban Rural Epidemiologic (PURE) Study. *J Cachexia Sarcopenia Muscle*,7, pp.535-546.

Mainous, A.G., Tanner, R.J., Anton, S.D., & Jo, A., 2015. Grip Strength as A Marker of Hypertension and Diabetes in Healthy Weight Adults. *Am J Prev Med*, 49(6), pp.850-858.

Manoharan, V.S., Sundaram, S.G., & Jasim, J.I., 2013. Factors Affecting Hand Grip Strength and Its Evaluation: A Systemic Review. *Int J Physiother Res*, 3(6), pp.1288-1293.

McGrath, R., Johnson, N., Klawitter, L., Mahoney, S., Trautman, K., Carlson, C., Rockstad, E., & Hackney, K.J., 2020. What Are The Association Patterns Between Handgrip Strength and Adverse Health Conditions? A Topical Review. *SAGE Open Medicine*, 8, pp.1-12.

Nakanishi, S., Shimodin, M., Kimura, T., Sanada, J., Fushimi, Y., Inamoto, Y., Iwamoto, H., Dan, K., Mune, T., Kaku, K., & Kaneto, H., 2024. The Impact of Handgrip Strength and Waist Circumference on Glycemic Control: Prospective, Observational Study Using Outpatient Clinical Data in Japanese Patients With Type 2 Diabetes Mellitus. *J Diabetes Investig*., 15(7), pp.892-898.

Nathania, N.P.S., Nugraha, M.H.S., Primayanti, I.D.A., & Saraswati, P.A.S., 2023. Handgrip Strength is Associated With Balance in Elderly Women. *Majalah Ilmiah Fisioterapi Indonesia*, 11, pp.70-75.

Gubernur Provinsi Daerah Khusus Ibukota Jakarta., 2017. *Peraturan Gubernur Provinsi Daerah Khusus Ibukota Jakarta Nomor 7 tahun 2017 Tentang Penanganan Prasarana dan Sarana Umum Tingkat Kelurahan*. Jakarta 2017.

Richter, E.A., & Hargreaves, M., 2013. Exercise, GLUT4, and Skeletal Muscle Glucose Uptake. *Physiol Rev*., 93(3), pp.993-1017.

Rokhmah, F.D., Handayani, D., & Al-Rasyid, H., 2015. Korelasi Lingkar Penggang dan Rasio Lingkar Penggang-Panggul Terhadap Kadar Glukosa Plasma Menggunakan Tes Toleransi Glukosa Oral. Jurnal Gizi Klinik Indonesia, 12, pp.28-33.

Rondhianto., Ridlo, A.Z., & Hasan, H., 2024. Sociodemographic Factors Affecting Diabetic Dietary Behavior in People with Type 2 Diabetes Mellitus. *KEMAS*, 19(3), pp.629-637.

Safitri, I., Setyarsih, L., Susanto, H., Suharsimo., & Fitranti, D.Y., 2020. The Effect of Low and High Glycemic Load Diet on Muscle Fatigue of Young Soccer Athletes. *KEMAS*, 16(1), pp.111-120.

Schrager, M.A., Metter, E.J., Simonsick, E., Ble, A., Bandinelli, S., Lauretani, F., & Ferrucci, L., 2007. Sarcopenic Obesity and Inflammation in The Inchianti Study. *J Appl Physiol*., 102(3), pp.919-925.

Sirajudeen, M.S., Shah, U.N., Pillai, P.S., Mohsin, N., & Shantacram, M., 2012. Correlation Between Grip Strength and Physical Factors in Men. *International Journal of Health and Rehabilitation Sciences*, 1, pp.58-63.

Soenyoto, T., Mollaji, K., & Mangrong, J., 2017. Correlation of Energy and Protein Consumption Levels with Physical Endurance of Rhythmic Gymnast Athletes. *KEMAS*, 13(1), pp.131-136.

Soraya, N., & Purwanto, R., 2023. The Controversial Relationship Between Body Mass Index and Handgrip Strength in The Elderly: An Overview. *Malaysi J Med Sci*., 30, pp.73-85.

Vaishya, R., Misra, A., Vaish, A., Ursino, N., & D'Ambrosi, R., 2024. Hand Grip Strength as A Proposed New Vital Sign Of Health: A Narrative Review of Evidences. *Journal of Health, Population and Nutrition*, 43, pp.1-

14.

Widjaja, D., Tjhai, K., Dermawan, K., Kalim, I., Ismail, S., Pramanta, A., Phenca, H.K., Siamiawan, A., 2018. *Correlations Between Hand Grip Strength and Anthropometric Status in Young Indonesian Adults*. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases: Krakow, Poland.

Zaccagni, L., Toselli, S., Bramanti, B., Gualdi-Russo, E., Mongillo, J., & Rinaldo, N., 2020. Handgrip Strength in Young Adults: Association With Anthropometric Variables and Laterality. *Int J Environ Res Public Health*, 17, pp.1–18.

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93	Jurnal Ilmu Sosial dan Ilmu Politik	Universitas Gadjah Mada	http://jurnal.ugm.ac.id/jsp
94	Journal of Indonesian Economy and Business	Universitas Gadjah Mada	https://journal.ugm.ac.id/v3/jieb/index
95	ESENSIA: Jurnal Ilmu-Ilmu Ushuluddin	Universitas Islam Negeri Sunan Kalijaga	https://ejournal.uin-suka.ac.id/ushuluddin/esensia/index
96	Ahkam: Jurnal Ilmu Syariah	Universitas Islam Negeri Syarif Hidayatullah	http://journal.uinjkt.ac.id/index.php/ahkam
97	Media Hukum	Universitas Muhammadiyah Yogyakarta	http://journal.umy.ac.id/index.php/jmh/index
98	k@ta	Universitas Kristen Petra	https://kata.petra.ac.id/
98	Jurnal Akuntansi dan Keuangan	Universitas Kristen Petra	https://jurnalakuntansi.petra.ac.id

99	Electronic Journal of Graph Theory and Applications	Indonesian Combinatorial Society (InaCombS), Graph Theory and Applications (GTA) Researc	http://www.ejgta.org/index.php/ejgta/index
100	IJOG : Indonesian Journal on Geoscience	Kementerian Energi dan Sumber Daya Mineral	http://ijog.bgl.esdm.go.id
101	Journal of Islamic Architecture	Universitas Islam Negeri Maulana Malik Ibrahim	http://ejournal.uin-malang.ac.id/index.php/JIA
102	Jurnal Penelitian Kehutanan Wallacea	Kementerian Lingkungan Hidup dan Kehutanan	https://journal.unhas.ac.id/index.php/wallacea
103	Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (Journal of Natural Resources and Environmental Management)	Institut Pertanian Bogor	https://journal.ipb.ac.id/index.php/jpsl
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106	CommIT (Communication and Information Technology) Journal	Universitas Bina Nusantara	https://journal.binus.ac.id/index.php/commit/index
107	Wacana: Journal of the Humanities of Indonesia	Universitas Indonesia	https://scholarhub.ui.ac.id/wacana/
108	International Journal of Renewable Energy Development : JRED	Universitas Diponegoro	https://ijred.cbiore.id/index.php/ijred/index
109	Journal of Education and Learning (EduLearn)	Universitas Ahmad Dahlan	http://edulearn.intelektual.org
110	Journal of Degraded and Mining Lands Management	Universitas Brawijaya	https://jdmlm.ub.ac.id/
111	Jurnal Elektronika dan Telekomunikasi	Lembaga Ilmu Pengetahuan Indonesia	http://www.jurnalet.com
112	Brawijaya Law Journal : Journal of Legal Studies	Universitas Brawijaya	http://lawjournal.ub.ac.id/index.php/law/index

113	Geoplanning: Journal of Geomatics and Planning	Universitas Diponegoro	http://ejournal.undip.ac.id/index.php/geoplanning/
114	Hasanuddin Law Review	Universitas Hasanuddin	http://pasca.unhas.ac.id/ojs/index.php/halrev
115	The Indonesian Biomedical Journal	Prodia Education and Research Institute	http://inabj.org/
116	Kesmas: Jurnal Kesehatan Masyarakat Nasional (National Public Health Journal)	Universitas Indonesia	https://journal.fkm.ui.ac.id/kesmas/issue/archive
117	Jurnal Ilmiah Islam Futura	Universitas Islam Negeri Ar-Raniry	https://jurnal.ar-raniry.ac.id/index.php/islamfutura
118	Etikonomi	Universitas Islam Negeri Syarif Hidayatullah	http://journal.uinjkt.ac.id/index.php/etikonomi
119	Mazahib Jurnal Pemikiran Hukum Islam	UIN Sultan Aji Muhammad Idris Samarinda	https://journal.uinsi.ac.id/index.php/mazahib
120	ULUL ALBAB Jurnal Studi Islam	Universitas Islam Negeri Maulana Malik Ibrahim	https://ejournal.uin-malang.ac.id/index.php/ululalbab/index
121	Indonesian Journal of International Law	Universitas Indonesia	https://scholarhub.ui.ac.id/ijil
122	Yustisia	Universitas Sebelas Maret	https://jurnal.uns.ac.id/yustisia/index
123	Indonesian Journal of Pharmacy	Universitas Gadjah Mada	http://indonesianjpharm.farmasi.ugm.ac.id/index.php/3
124	Jurnal Keperawatan Indonesia	Universitas Indonesia	http://jki.ui.ac.id/index.php/jki
125	VALENSI	Universitas Islam Negeri Syarif Hidayatullah	http://journal.uinjkt.ac.id/index.php/valensi
126	International Journal of Advances in Intelligent Informatics	Universitas Ahmad Dahlan	http://ijain.org/index.php/IJAIN/index
127	Jurnal Ilmiah Peuradeun	SCAD Independent	https://journal.scadindependent.org/index.php/jipeuradeun
128	SAINS TANAH - Journal of Soil Science and Agroclimatology	Universitas Sebelas Maret	https://jurnal.uns.ac.id/tanah

129	Indonesian Journal of Electical Engineering and Informatics (IJEEI)	Institute of Advanced Engineering and Science (IAES)	http://section.iaesonline.com/index.php/IJEEI/index
130	Indonesian Journal of Applied Linguistics (IJAL)	Universitas Pendidikan Indonesia	http://ejournal.upi.edu/index.php/IJAL
131	Buletin Ekonomi Moneter dan Perbankan	Bank Indonesia	https://www.bmeb-bi.org/index.php/BEMP/
132	International Journal on Emerging Mathematics Education	Universitas Ahmad Dahlan	http://journal.uad.ac.id/index.php/IJEME
133	JURNAL INFOTEL	Institut Teknologi Telkom Purwokerto	https://ejournal.ittelkom-pwt.ac.id/index.php/infotel
134	Jurnal Sylva Lestari	Universitas Lampung	http://jurnal.fp.unila.ac.id/index.php/JHT
135	Al-Jabar: Jurnal Pendidikan Matematika	Universitas Islam Negeri Raden Intan	http://ejournal.radenintan.ac.id/index.php/al-jabar/issue/archive
136	Forest and Society	Universitas Hasanuddin	http://journal.unhas.ac.id/index.php/fs/index
137	Journal of the Civil Engineering Forum	Universitas Gadjah Mada	https://jurnal.ugm.ac.id/v3/jcef/
138	JURNAL IUS KAJIAN HUKUM DAN KEADILAN	Universitas Mataram	http://jurnalius.ac.id/ojs/index.php/jurnalIUS
139	Public Health of Indonesia	Ikatan Ahli Kesehatan Masyarakat (IAKMI) Pengurus Daerah Sulawesi Tenggara	http://stikbar.org/ycabpublisher/index.php/PHI/index
140	JOIN (Jurnal Online Informatika)	Universitas Islam Negeri Sunan Gunung Djati	https://join.if.uinsgd.ac.id/index.php/join
141	QIJIS (Qudus International Journal Of Islamic Studies)	STAIN Kudus	http://journal.stainkudus.ac.id/index.php/QIJIS
142	Habitat	Universitas Brawijaya	https://habitat.ub.ac.id/index.php/habitat
143	Jurnal Civics: Media Kajian Kewarganegaraan	Universitas Negeri Yogyakarta	https://journal.uny.ac.id/index.php/civics/index
144	Al-Ihkam: Jurnal Hukum dan Pranata Sosial	Institut Agama Islam Negeri Madura	http://ejournal.iainmadura.ac.id/index.php/alihkam/index

145	ASEAN Journal on Science and Tecnology for Development	Universitas Gadjah Mada	http://ajstd.org/index.php/ajstd/index
146	Bali Journal of Anesthesiology	Universitas Udayana	http://www.bjoaonline.com/
147	Belitung Nursing Journal	Belitung Raya Foundation	http://belitungraya.org/BRP/index.php/bnj
148	INDONESIAN JOURNAL OF APPLIED PHYSICS	Universitas Sebelas Maret	https://jurnal.uns.ac.id/ijap
149	Jurnal Infinity	Institut Keguruan dan Ilmu Pendidikan Siliwangi	http://e-journal.stkipsiliwangi.ac.id/index.php/infinity
150	Jurnal Pendidikan Matematika	Universitas Sriwijaya	https://jpm.ejournal.unsri.ac.id/index.php/jpm
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153	Sriwijaya Law Review	Universitas Sriwijaya	http://journal.fh.unsri.ac.id/index.php/sriwijayalawreview/issue/archive
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156	Journal on Mathematics Education	Universitas Sriwijaya	https://jme.ejournal.unsri.ac.id/index.php/jme
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158	JURNAL ILMIAH PENDIDIKAN FISIKA AL BIRUNI	Universitas Islam Negeri Raden Intan	http://ejournal.radenintan.ac.id/index.php/al-biruni/index
159	Jurnal Kedokteran dan Kesehatan Indonesia	Universitas Islam Indonesia	https://journal.uii.ac.id/JKKI
160	Bali Medical Journal	Universitas Udayana	http://www.balimedicaljournal.id

161	Udayana Journal of Law and Culture	Universitas Udayana	https://ejournal4.unud.ac.id/index.php/ujlc/en
162	Indonesian Aquaculture Journal	Kementerian Kelautan dan Perikanan	http://ejournal-balitbang.kkp.go.id/index.php/iaj/index
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167	Record and Library Journal	Universitas Airlangga	https://e-journal.unair.ac.id/RLJ/index
168	Squalen Bulletin Of Marine And Fisheries Postharvest And Biotechnology	Kementerian Kelautan dan Perikanan	https://www.bbp4b.litbang.kkp.go.id/squalen-bulletin/index.php/squalen/index
169	International Journal of Evaluation and Research in Education (IJERE)	Institute of Advanced Engineering and Science (IAES)	http://ijere.iaescore.com/index.php/IJERE
170	Indonesian Journal of Cancer Chemoprevention	Indonesian Society for Cancer Chemoprevention	https://ijcc.chemoprev.org/index.php/ijcc/
171	Formatif: Jurnal Ilmiah Pendidikan MIPA	Universitas Indraprasta PGRI	http://journal.lppmunindra.ac.id/index.php/Formatif/user
172	Communications in Science and Technology	Komunitas Ilmuwan dan Profesional Muslim Indonesia (KIPMI) Yogyakarta	https://cst.kipmi.or.id
173	Caraka Tani: Journal of Sustainable Agriculture	Universitas Sebelas Maret	http://jurnal.uns.ac.id/carakatani/
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176	Jurnal Pendidikan Agama Islam	Universitas Islam Negeri Sunan Kalijaga	http://ejournal.uin-suka.ac.id/tarbiyah/index.php/jpai/index

177	Journal of the Indonesian Mathematical Society	Indonesian Mathematical Society (IndoMS)	https://jims-a.org
178	Jurnal Geografi	Universitas Negeri Medan	http://jurnal.unimed.ac.id/2012/index.php/geo/editor
179	Indonesian Journal of Science and Technology	Universitas Pendidikan Indonesia	http://ejournal.upi.edu/index.php/ijost/
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103	Jurnal Ilmiah Ilmu Terapan Universitas Jambi	Universitas Jambi	https://online-journal.unja.ac.id/index.php/JIITUJ/issue/archive
104	Asy-Syari'ah	Universitas Islam Negeri Sunan Gunung Djati	http://journal.uinsgd.ac.id/index.php/asy-syariah/index
105	JOIV : International Journal on Informatics Visualization	Politeknik Negeri Padang	http://joiv.org/index.php/joiv
106	Indonesian Journal of Urban and Environmental Technology	Universitas Trisakti	https://e-journal.trisakti.ac.id/index.php/urbanenvirotech
107	Islamic Guidance and Counseling Journal	Universitas Ma'arif Lampung	https://journal.iaimnumetrolampung.ac.id/index.php/igcj
108	Legality : Jurnal Ilmiah Hukum	Universitas Muhammadiyah Malang	http://ejournal.umm.ac.id/index.php/legality
109	Tasfiyah: Jurnal Pemikiran Islam	Universitas Darussalam Gontor	https://ejournal.unida.gontor.ac.id/index.php/tasfiyah
110	Jurnal Medik Veteriner	Universitas Airlangga	https://e-journal.unair.ac.id/JMV/issue/archive
111	SAMARAH: Jurnal Hukum Keluarga dan Hukum Islam	Universitas Islam Negeri Ar-Raniry Banda Aceh	https://jurnal.ar-raniry.ac.id/index.php/samarah/index
112	Nazhruna: Jurnal Pendidikan Islam	Universitas KH. Abdul Chalim	http://e-journal.ikhac.ac.id/index.php/NAZHRUNA
113	Lex Scientia Law Review	Universitas Negeri Semarang	https://journal.unnes.ac.id/journals/lslr
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118	Journal of Local Government Issues (Logos)	Universitas Muhammadiyah Malang	http://ejournal.umm.ac.id/index.php/LOGOS/index
119	JP3I (Jurnal Pengukuran Psikologi dan Pendidikan Indonesia)	Universitas Islam Negeri Syarif Hidayatullah Jakarta	http://journal.uinjkt.ac.id/index.php/jp3i
120	Ulul Albab: Jurnal Studi dan Penelitian Hukum Islam	Universitas Islam Sultan Agung	https://jurnal.unissula.ac.id/index.php/ua/index
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127	Science and Technology Indonesia	Universitas Sriwijaya	http://sciencetechindonesia.com/index.php/jsti
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130	Volksgeist: Jurnal Ilmu Hukum dan Konstitusi	Institut Agama Islam Negeri Purwokerto	http://ejournal.uinsaizu.ac.id/index.php/volksgeist/issue/archive
131	CHEESA: Chemical Engineering Research Articles	Universitas PGRI Madiun	http://e-journal.unipma.ac.id/index.php/cheesa

132	IAES International Journal of Artificial Intelligence	Institute of Advanced Engineering and Science (IAES)	http://ijai.iaescore.com/index.php/IJAI
133	Jambe Law Journal	Universitas Jambi	http://jlj.unja.ac.id/index.php/home/index
134	Jambura Law Review	Universitas Negeri Gorontalo	http://ejurnal.ung.ac.id/index.php/jalrev
135	Bestuur	Universitas Sebelas Maret	https://jurnal.uns.ac.id/bestuur/index
136	Indonesian Journal of Halal Research	Universitas Islam Negeri Sunan Gunung Djati Bandung	https://journal.uinsgd.ac.id/index.php/ijhar/index
137	International Journal of Education and Learning	Association for Scientific Computing Electronics and Engineering (ASCEE)	http://pubs2.ascee.org/index.php/ijele
138	Indonesian Journal Of Medical Laboratory Science And Technology	Universitas Nahdlatul Ulama Surabaya	https://journal2.unusa.ac.id/index.php/IJMLST
139	Indonesian Food Science and TechnologyJournal	Universitas Jambi	https://online-journal.unja.ac.id/ifstj
140	International Journal of Islamic Khazanah	Universitas Islam Negeri Sunan Gunung Djati Bandung	https://khazanah.uinsgd.ac.id/index.php/ijik
141	El-Usrah : Jurnal Hukum Keluarga	Universitas Islam Negeri Ar-Raniry Banda Aceh	https://jurnal.ar-raniry.ac.id/index.php/usrah
142	Teknomekanik	Universitas Negeri Padang	http://teknomekanik.ppj.unp.ac.id/index.php/teknomekanik
143	Jurnal Hukum	Universitas Islam Sultan Agung	http://jurnal.unissula.ac.id/index.php/jurnalhukum
144	Journal of Innovation in Educational and Cultural Research	Yayasan Keluarga Guru Mandiri	http://jiecr.org/index.php/jiecr
145	Journal of Tropical Biodiversity and Biotechnology	Universitas Gadjah Mada	https://journal.ugm.ac.id/jtbb
146	APTISI Transactions on Technopreneurship	APTISI	https://att.aptisi.or.id/index.php/att
147	International Journal of Reconfigurable and Embedded Systems (IJRES)	Institute of Advanced Engineering and Science	http://ijres.iaescore.com/index.php/IJRES

148	Journal of Law and Legal Reform	Universitas Negeri Semarang	https://journal.unnes.ac.id/journals/jllr
149	Khazanah Hukum	Universitas Islam Negeri Sunan Gunung Djati Bandung	https://khazanah.uinsgd.ac.id/index.php/kh
150	International Journal of Advances in Applied Sciences	Institute of Advanced Engineering and Science	http://ijaas.iaescore.com/index.php/IJAAS
151	International Journal of Applied Power Engineering (IJAPE)	Institute of Advanced Engineering and Science	http://ijape.iaescore.com/index.php/IJAPE
152	Journal of Applied Engineering and Technological Science (JAETS)	Yayasan Pendidikan Riset dan Pengembangan Intelektual	https://journal.yrpipku.com/index.php/jaets
153	Journal of Robotics and Control (JRC)	Universitas Muhammadiyah Yogyakarta	https://journal.umy.ac.id/index.php/jrc/index
154	TARBIYA: Journal of Education in Muslim Society	Universitas Islam Negeri Syarif Hidyatullah	http://journal.uinjkt.ac.id/index.php/tarbiya
155	Ulumuna	Universitas Islam Negeri Mataram	https://ulumuna.or.id/index.php/ujis
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158	Advance Sustainable Science, Engineering and Technology (ASSET)	Universitas PGRI Semarang	http://journal.upgris.ac.id/index.php/asset
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162	Kanz Philosophia: A Journal for Islamic Philosophy and Mysticism	Sekolah Tinggi Agama Islam Sadra	https://journal.sadra.ac.id/ojs/index.php/kanz
163	PETITA: Jurnal Kajian Ilmu Hukum dan Syariah	Universitas Islam Negeri Ar-Raniry Banda Aceh	http://petita.ar-raniry.ac.id/index.php/petita

164	Mechanical Engineering for Society and Industry	Universitas Muhammadiyah Magelang	https://journal.unimma.ac.id/index.php/mesi
165	JHCLS	Lembaga Contrarius Institute	https://www.jhcls.org/index.php/JHCLS
166	Ascarya: Journal of Islamic Science, Culture and Social Studies	Perkumpulan Alumni Dan Santri Mahyajatul Qurro	http://journal.ascarya.or.id/index.php/iscs
167	Journal of Public Health and Pharmacy	Universitas Muhammadiyah Palu	https://jurnal.unismuhpalu.ac.id/index.php/jphp/index
168	Heart Science Journal	Universitas Brawijaya	https://heartscience.ub.ac.id/index.php/heartscience
169	The Indonesian Journal of Socio-Legal Studies	Universitas Indonesia	https://scholarhub.ui.ac.id/ijsls
170	Online Learning in Educational Research	Foundation Of Advanced Education	https://journal.foundae.com/index.php/oler
171	MILRev: Metro Islamic Law Review	Universitas Islam Negeri Jurai Siwo Lampung	https://e-journal.metrouniv.ac.id/index.php/milrev
172	Journal of Coaching and Sports Science	Cv. Foundae	https://journal.foundae.com/index.php/jcss
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Judul artikel : " **Handgrip Strength of Public Works Personnel in West Jakarta**"

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Penulis : Alvina,Pusparini, Mario, Yasmine Mashabi.

No	Perihal	Tanggal
1	Bukti konfirmasi submit artikel dan artikel yang disubmit	29 Mei 2025
2	Bukti konfirmasi review dan hasil review pertama	22 Juni 2025
3	Bukti konfirmasi submit revisi pertama, respon kepada reviewer, dan artikel yang diresubmit	22 Juni 2025
4	Bukti konfirmasi review dan hasil review kedua	21 Juli 2025
5	Bukti konfirmasi submit revisi kedua, respon kepada reviewer, dan artikel yang diresubmit	21 Juli 2025
6	Bukti Accepted artikel	1 Agustus 2025
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1. Bukti konfirmasi submit artikel dan artikel yang disubmit
(29 Mei 2025)

UNIVERSITAS TRISAKTI

Alvina fk <dr.alvina@trisakti.ac.id>

Thank you for your submission to Jurnal Kesehatan Masyarakat

1 message

Prof. Dr. dr. Oktia Woro Kasmini Handayani, M.Kes <kemas@mail.unnes.ac.id> Thu, May 29, 2025 at 5:05 PM
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Factors Associated With Handgrip Strength of Public Works Personnel in West Jakarta

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Abstract

Public Works Personnel (PWP) in Jakarta perform their routine duties manually instead of using equipment. Handgrip strength (HGS) measures maximum hand strength as a quality indicator for muscle strength and mass. Factors affecting muscle strength are age, sex, body mass index (BMI), waist circumference (WC), and hip circumference (HC). Increased fasting blood glucose (FBG) is also associated with muscle quality, muscle strength, and physical performance. This study aimed to determine the factors associated with handgrip strength in PWP. A total of 192 male PWP from the Cengkareng district were recruited by simple random sampling. Collected data were demographics, BMI, FBG, WC, HC, and HGS. Statistical analysis was done using Pearson's correlation test and multiple regression analysis. There was a significant positive correlation of BMI, WC, and HC with HGS ($p=0.006$; $r=0.20$, $p=0.009$; $r=0.19$ and $p=0.005$; $r=0.20$) and a significant negative correlation between age and HGS ($p=0.008$; $r=-0.19$) but not between FBG and HGS ($p=0.847$). Multiple regression analysis showed height, BMI, and HC positively predicting HGS ($R^2=0.19$). Handgrip strength of public works personnel is associated with BMI, age, waist circumference, and hip circumference, but not with fasting blood glucose. Height, BMI, and hip circumference predict handgrip strength.

Keywords: Handgrip strength, Body mass index, Hip circumference, Waist circumference, Fasting blood glucose

INTRODUCTION

Personnel for the management of public infrastructure and facilities at the village level are workers who manage village public works for a given time period on the basis of a work order. The tasks of village-level public works personnel (PWP) consist of managing the infrastructure and facilities, such as streets, drains, and parks, including installed lights (Peraturan Gubernur DKI Jakarta, 2017). The work performed by village PWP consists mainly of intense physical activity involving the hands, such that handgrip strength is essential in their tasks. Lowering of handgrip strength may indicate reduced muscle strength, which may especially interfere with the daily activities of village PWP that consist mainly of manual labor.

Handgrip strength measures maximal hand strength and indicates muscle quality that reflects muscle strength and mass. Muscle strength refers to the ability of muscle groups to raise a given load. Low or poor grip strength is frequently associated with damaging health impacts, such as chronic disease, and is the initial sign of reduced muscle mass, limitations in physical functions, and mortality risk. Poor handgrip strength may also reduce a person's ability to perform activities of daily living and, therefore, impact quality of life (Soraya et al., 2023; Nathania et al., 2023).

Handgrip strength may represent the strength of all muscles in the body. Several factors possibly influencing an individual's muscle strength are age, sex, and body mass index (BMI) (Soraya et al., 2023). Handgrip strength is also associated with chronic diseases such as diabetes, metabolic syndrome, and cardiovascular disease. Increased glucose concentration is also associated with disorders of muscle quality and strength, as well as physical performance (Chen et al., 2023). In the present study, we included fasting blood glucose concentrations in the data collection in order to obtain more accurate measures of glucose concentrations that have not yet been influenced by food intake.

Handgrip strength may be a health indicator that provides information on a person's health (Vaishya et al., 2024). However, its clinical significance in determining the prevention and treatment of poor handgrip remains limited because of the still unclear etiology of muscle weakness, especially because the clinical outcomes associated with handgrip strength are extremely diverse (Mc Grath et al., 2020). The relationship between BMI and handgrip strength is still controversial, with several investigators finding a significant positive association and others reporting a non-significant relationship (Al Asadi, 2018).

There are few studies on handgrip strength, especially on workers in the sanitation sector such as public works personnel, such that the present investigators were interested in studying this topic. The aim of the present study was to determine the factors associated with handgrip strength in public works personnel.

METHOD

This cross-sectional study involving male public works personnel in Cengkareng District, West Jakarta, was conducted from September to October 2024. The study sample was selected by simple random sampling. Calculation of the sample size for a correlation with $r=0.2$, $Z\alpha=0.05$, and $Z\beta=0.1$, resulted in a sample of 192 subjects who met the inclusion criterion of being male and 25-

60 years old, and the exclusion criteria of having an abnormality of the hands, heart disease, pulmonary disease, and malignancies.

Measurements were obtained on height in cm, weight in kg, as well as waist circumference and hip circumference in cm. Height and weight were determined using microtoise and digital scales, respectively. BMI was calculated using the formula of weight divided by height squared. Measurement of waist and hip circumferences was done using measuring tape. Waist circumference was determined with the subject in the upright position, at the end of a normal expiration, at the smallest abdominal circumference between the iliac crest and twelfth rib. The cut-off values for waist circumference in males and females are ≥ 90 cm and ≥ 80 cm, respectively. Hip circumference was measured using measuring tape that was applied around the hips at the level of the symphysis pubis and the maximal gluteal circumference (Rokhmah et al., 2015; Ilmi et al., 2020).

Fasting blood glucose (FBG) concentration was determined on venous blood by the hexokinase method after the respondents had fasted approximately 10 hours prior. Handgrip strength was measured with a handgrip strength dynamometer to the nearest kilogram as follows: The respondent was asked to sit down comfortably without reclining and with the feet completely relaxed. The hips and knees were positioned at a 90^0 angle, the gripping hand with the shoulder in adduction, the elbow flexed 90^0, and the forearm and wrist in the neutral position. The gripping duration was 3 seconds. The respondent gripped the instrument with the dominant hand as hard as possible and the value indicated by the needle was recorded. In accordance with the protocol recommended by the American Society of Hand Therapists (ASHT), the recorded handgrip strength was the average of three handgrip strength tests (Nathania et al., 2023).

Prior to data analysis by means of the correlation test, the normality of the data distribution was determined using the Kolmogorov-Smirnov test. The Pearson correlation test was used for a normal data distribution, whereas for a non-normal data distribution, the Spearman correlation test was done, followed by a multiple regression analysis.

Ethics approval was issued by the Ethics Committee of the Faculty of Medicine, Universitas Trisakti, under No. 033/KER/FK/08/2024.

RESULT AND DISCUSSION

In this study the respondents comprised 192 male public works personnel of Cengkareng District that consisted of the villages (subdistricts) of Kedaung, Duri Kosambi, West Cengkareng, Kapuk, and Rawa Buaya. A total of 26% of the respondents were residents of Duri Kosambi, where Muslims comprised 98.4% of the population. The majority of the respondents at 77.6% had an educational level of senior high school, nearly all of the respondents, or 99%, were right-handed, using the right hand as the dominant one at work, and most were of the Betawi (Jakarta) ethnic group at 51.6% (Table 1).

Table 1. Demographic data of the respondents

Characteristic	N (%)
Village	
Kedaung	40 (20.8)
Duri Kosambi	50 (26)
Cengkareng Barat	33 (17.2)
Kapuk	43 (22.4)
Rawa Buaya	26 (13.5)
Religion	
Islamic	189 (98.4)
Christian	2 (1)
Catholic	1 (0.5)
Level of education	
Elementary school	7 (3.6)
Junior high school	29 (15.1)
Senior high school	149 (77.6)
Academy-University	7 (3.6)
Dominant hand	
Right hand	190 (99)
Left hand	2 (1)
Ethnic group	
Javanese	53 (27.6)
Betawi	99 (51.6)
Sundanese	25 (13)
Other	14 (7.3)

Legend: Other ethnicities comprised groups from Palembang, Lampung, Bima, and Kupang

Table 2. Respondents' characteristics

Variable	Mean ± SD
Age (years)	40.9 ± 8.9
Height (cm)	164.6 ± 6.7
Weight (kg)	64.7 ± 13.1
BMI (kg/m^2)	23.8 ± 4.3
Waist circumference (cm)	85.4 ± 10.4
Hip circumference (cm)	96.9 ± 8.4
HGS (kg)	33.1 ± 6.9
FBG (mg/dL)	87 (64-280)*

Legend: BMI: body mass index. *FBG: fasting blood glucose, expressed as Median (Min-Max).
HGS: handgrip strength

The bivariate analysis found a significant positive correlation of BMI, height, weight, waist circumference, and hip circumference with handgrip strength (p=0.006, r=0.20; p=<0.001, r=0.36; p=<0.001, r=0.32; p=0.009, r=0.19; p= 0.005; r=0.20, respectively). This showed that the larger the BMI, height, weight, waist circumference, and hip circumference, the stronger the handgrip. However, there was no significant relationship between fasting glucose concentration and handgrip strength (p=0.847). This study also found that age had a significant negative correlation with handgrip strength (p=0.011; r= -0.182), signifying that the older a person, the lower the handgrip strength (Table 3). Results of multiple regression analysis on handgrip strength are listed in Table 4.

Table 3. Analysis of the relationship of age, height, weight, BMI, waist circumference, hip circumference, and fasting blood glucose concentration with handgrip strength

Variable	R	P value
Age	- 0.19	0.008*
Height	0.36	0.000*
Weight	0.32	0.000*
BMI	0.20	0.006*
Waist circumference	0.19	0.009*
Hip circumference	0.20	0.005*
FBG	0.02	0.847#

*P value with Pearson's test, # Spearman's test

Table 4. Multiple regression analysis on handgrip strength

Determinant	b	SE	p
Height	0.48	0.08	0.000
BMI	0.79	0.22	0.000
Hip circumference	- 0.29	0.12	0.015
Constant	- 36.98		

R^2=0,19

This study found that most of the public works personnel in Duri Kosambi village were Muslims, had a senior high school level of education, and were of Betawi ethnicity. This was in line with the demographic data in Cengkareng district, in that Duri Kosambi was the village with the greatest area, the majority of the residents were male, and the Islamic religion had the most believers (Badan Pusat Statistik Jakarta Barat, 2020).

Among the respondents of this study, the dominant right hand was used for working. In the adult population, a total of 90% of the residents preferred to use the right hand for manual tasks, whereas around 10% used the left hand (Zaccagni et al., 2020). According to Agtuahene et al. (Agtuahene et al., 2023), the dominant hand is generally around 10% stronger than the non-dominant hand. Many activities in daily life need a high level of exertion of the muscles of the hand and forearm (Hammed et al., 2017). The frequent use of the dominant hand in daily living results in the muscles of the hand and forearm providing strength in gripping (Afaq et al., 2019).

The mean handgrip strength in this study was 33.1 ± 6.9 kg, which is relatively low if compared with the study results of Kurniawan et al. (Kurniawan et al., 2018). in healthy young

Indonesian adults, where mean handgrip strength in males was 37.37 ± 8.29 kg and the lower limit of muscle strength in Indonesian males was 20.79 kg. The handgrip strength results in both studies are still below those of males in other Southeast Asian countries, according to the study results of Leong et al. (Leong et al., 2016). These investigators found that the mean handgrip strength in Southeast Asian males aged 35-40 years was 40 kg (34-44 kg); for the age range of 41-50 years, the handgrip strength was 38 kg (33-44 kg), for the age range of 51-60 years it was 34 kg (30-40 kg), and for ages 61-70 years 30 kg (24-34 kg). This may have been caused by ethnic differences mediated by genetic differences that also affect individual muscle strength. The highest handgrip strength is found in the European and North American populations, whereas the lowest handgrip strength is found in African, South Asian, and Southeast Asian populations. These variations in muscle strength in various countries may also be partly caused by differences in socio-economic status (Leong et al., 2016).

According to Agtuahene et al. (Agtuahene et al., 2023), handgrip strength is a physiological variable influenced by several factors, such as age, sex, and body measurements. In contrast, according to Zaccagni et al. (Zaccagni et al., 2020), handgrip strength, apart from being affected by age, may also be influenced by physical activity, grip measurement, height, and body mass.

The present study found a significant positive correlation between BMI and handgrip strength. According to Hammed et al., this may be caused by the higher percentage of skeletal muscle mass compared to the percentage of fat mass, thereby resulting in a higher handgrip strength [13]. Our study's results are identical to those of Agtuahene et al. (Agtuahene et al., 2023), who found a significant positive correlation (r= 0.290) of handgrip strength with BMI and height. This shows that taller individuals with higher BMI apparently have greater handgrip strength. Our study is also in line with the study of Krakauer in 2020, which showed a positive correlation between BMI and handgrip strength (Krakauer et al., 2020).

The study of Cooper et al. (Cooper et al., 2022) concluded that a high childhood BMI is associated with higher grip strength at age 46 years. This is because fat mass acts as a mechanical load that elicits an anabolic response that stimulates muscle growth and function. This anabolic response is usually greater in males than in females because of the higher testosterone concentration in males. However, it should also be noted that BMI does not differentiate between fat mass and lean mass as adipocyte indicators that may vary with sex. It should be noted that BMI is a measure of body fat that does not differentiate between weight changes as a result of an increase or decrease in muscle mass or body fat (Zaccagni et al., 2020). According to Jafar et al. (Jaafar et al., 2023), heavier individuals have a greater muscle mass, resulting in greater handgrip strength, than lighter individuals.

In the study of Heidy et al. (Heidy et al., 2019), the investigators found a positive correlation between height and forearm length. The study by Sirajudeen et al. (Sirajudeen et al., 2012) found a positive correlation between hand length and handgrip strength. This shows that height affects the longer extremity or arm, thus approaching optimal muscle length that may result in greater grip strength. According to a prospective cohort study, handgrip strength in middle age appears to be associated with birth weight and the increase in height at puberty. Pubertal growth and handgrip strength possibly represent the development of muscle size and growth (Schrager et al., 2007).

Our study found no relationship between blood glucose concentration and handgrip strength. Our study agrees with the study of Giglio et al. (Giglio et al., 2018), which showed no significant relationship between muscle mass strength and blood glucose concentration. According to Giglio, this is because most respondents are individuals who routinely perform structured

physical activity, even though they are in the light category. This is similar to our study respondents, who were public works personnel and who had performed physical activity such as street sweeping and cleaning storm drains.

Glucose is the main fuel for muscle contraction, entering the muscle cells by diffusion through the GLUT4 glucose transporter, which, after muscle contraction, moves from its intracellular storage site to the plasma membrane and T-tubules (Richter et al., 2013). Glucose metabolism has an influence on handgrip strength through various mechanisms, such as disorders of glucose metabolism, particularly glycogenolysis, that may result in the loss of muscle strength. Insulin resistance in hyperglycemia may cause muscle degradation because hyperglycemia causes low muscle strength through effects on skeletal muscle mitochondria. The lowering of muscle strength by hyperglycemia occurs through Krüppel-like factor 15, which regulates skeletal muscle lipid flux. Hyperglycemia also increases pro-inflammatory cytokines, which may increase the catabolism that plays a role in the further decrease in muscle mass and quality (Gamayanti et al., 2023).

This study has a significant negative correlation between age and handgrip strength, which decreases with age (Manoharan et al., 2015). Handgrip strength initially experiences an increase with increasing age, reaches its peak between the age of 30 and 40 years, and decreases afterward (Zaccagni et al., 2020). The age-related changes in skeletal muscle composition, particularly the accumulation of lipids in skeletal muscle fibers, play a role in the poor quality of the muscles and may result in metabolic abnormalities such as insulin resistance. Apart from changes in muscle quality, there is also a reduction in muscle mass that is consistently occurring during aging. The increase in oxidative stress and chronic inflammation that commonly occurs in the aging process apparently also plays a role in the development of decreased muscle mass and strength (Mainous et al., 2015).

The decrease in muscle mass in the elderly corresponds to a 10% reduction in grip strength per decade, starting from the age of 40 years (Jaafar et al., 2023). Skeletal muscle plays an important role in glucose metabolism and has a significant influence on insulin sensitivity. Increased insulin resistance in older adults may be closely associated with skeletal muscle aging. A reduction in GLUT4 expression as a result of a decrease in muscle volume causes a reduction in insulin sensitivity in aging skeletal muscle (Joo et al., 2022).

The results of this study showed a correlation of waist circumference and hip circumference with handgrip strength. This is in line with the study of Widjaja et al. (Widjaja et al., 2018), who stated that there was a significant correlation of waist circumference and hip circumference with handgrip strength ($p=<0.001$, $r=0.302$; and $p=<0.001$, $r=0.296$) A greater waist circumference is associated with a greater handgrip strength in males (Hardy et al., 2013).

In the multiple regression analysis of HGS, we removed the data on body weight because of the occurrence of multicollinearity between weight and BMI, with a correlation coefficient of more than 0.9, indicating an extremely strong relationship between these two variables. Conceptually, only one of the variables is used in multivariate analysis. The multiple regression analysis included age, height, BMI, waist circumference, and hip circumference, with HGS as dependent variable in a stepwise dependent manner. After three iterations, only height, BMI, and hip circumference played a role in predicting HGS by means of the regression formula, which resulted in $R^2=0.19$. This signifies that for known values of height, BMI, and hip circumference, we can predict the HGS value 19% more accurately than without a knowledge of these data. For a clinical diagnosis, a minimum increase of 10% is needed. This study found that height, BMI, and

hip circumference play a role in predicting handgrip strength through the regression formula, i.e., handgrip strength = - 36.98 + 0.48 x height + 0.79 x BMI – 0.29 x hip circumference.

Handgrip strength and waist circumference are surrogate muscle strength and visceral adiposity markers, respectively (Nakanishi et al., 2024). Waist circumference is also more sensitive in determining body fat distribution, particularly in the abdomen. Waist circumference correlates better with abdominal fat distribution than BMI (Rokhmah et al., 2015). Waist circumference and hip circumference are associated with obesity, in which the fat content is higher, and the skeletal muscle and fascicular content is lower, thereby resulting in a lower contractile capacity of skeletal muscle (Afaq et al., 2019).

The limitation of this study is that it did not evaluate other factors that may affect handgrip strength, such as nutrient intake. From the anthropometric measures of the hands and feet in this study, the causes and effects of the decrease in handgrip strength could not be determined because this study used a cross-sectional design.

CONCLUSION

There are three factors that may be used to estimate handgrip strength in PWP, namely height, BMI, and hip circumference, whereas blood glucose concentration is not correlated with handgrip strength in PWP. It is recommended to pay attention to height, BMI, and hip circumference, particularly in the acceptance criteria of PWP candidates, and to conduct further studies with consideration of other factors that affect handgrip strength, such as food intake and anthropometric features of the hands and arms.

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REFERENCES

Afaq, E., Hassan, S.H., Khan, M.R., Zaidi, D.A., & Baktashi, H., 2019. Correlation of Hand Dynamometry With Body Mass Index and Waist Hip Ratio in Medical Students. Pak J Physiol,15, pp.19-21.

Agtuahene, M.A., Quartey, J., & Kwakye, S., 2023. Influence of Hand Dominance, Gender, and Body Mass Index on Hand Grip Strength. S Afr J Physiother, 79, pp.1-6. doi: org/10.4102/sajp.v79i1.1923.

Al-Asadi, J.N., 2018. Handgrip Strength in Medical Students: Correlation with Body Mass Index and Hand Dimensions. Asian Journal of Medical Sciences, 9, pp.21-26. doi: 10.3126/ajms.v9i1.18577.

Badan Pusat Statistik Kota Administrasi Jakarta Barat., 2020. Kecamatan Cengkareng Dalam Angka, pp. 1-114.

Chen, D., Zhu, Y., Ni, W., Li, Y., Yin, G., Shao, Z., & Zhu, J., 2023. Hand Grip Strength is Inversely Associated with Total Daily Insulin Dose Requirement in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study. PeerJ, pp.1-13. doi: 10.7717/peerj.15761.

Cooper, R., Tomlinson, D., Hamer, M., & Pereira, S.M.P., 2022. Lifetime Body Mass Index and Grip Strength at Age 46 Years: The 1970 British Cohort Study. J Cachexia Sarcopenia Muscle, 13, pp.1-10. doi: 10.1002/jcsm.12992.

Gamayanti, K.A.V., Aryana, I.G.P.S., & Gotera, W., 2023. Hubungan Antara Kekuatan Genggaman Tangan Dengan Kadar Gula Darah Sewaktu Pada Lansia Di Desa Melinggih, Kecamatan Payangan, Kabupaten Gianyar. Intisari Sains Medis, 14(2): pp.483-488.

Giglio, B.M., Mota, J.F., Wall, B.T., & Pimentel, G.D., 2018. Low Handgrip Strength is Not Associated With Type 2 Diabetes Mellitus and Hyperglycemia: A Population-Based Study. Clin Nutr Res, 7(2): pp.112-116. doi: 10.7762/cnr.2018.7.2.112.

Hammed, A.I., & Obaseki, C.O., 2017. Interdependence of Body Mass Index with Handgrip Strength and Endurance Among Apparently Healthy Teenagers. Turk J Kin, 4, pp.1-7.

Hardy, R., Cooper, R., Sayer, A.A., Shlomo, Y.B., Cooper, C., Deary, I.J., Demakakos, P., Gallacher, J., Martin, R.M., McNeill, G., et al., 2013. Body Mass Index, Muscle Strength and Physical Performance in Older Adults From Eight Cohort Studies: The Halcyon Programme. PLoS One, 8(2): pp.e56483. doi: 10.1371/journal.pone.0056483.

Heidy., Djuartina, T., & Irawan, R., 2019. Korelasi Kekuatan Genggaman Tangan Dengan Karakter Antropometri Lengan Bawah dan Tangan Serta Indeks Massa Tubuh. Damianus Journal of Medicine,18, pp.1-7.

Ilmi, A.F., & Utari, D.M., 2020. Hubungan Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul (RLPP) Terhadap Kadar Glukosa Darah Puasa Pada Mahasiswa. Journal of Nutrition College, 9, pp.222-227.

Jaafar, M.H., Ismail, R., Ismail, N.H., Isa, Z.M., Tamil, A.M., Nasir, N.M., Keat, N.K., Razak, N.H., Abidin, N.Z., & Yusof, K.H., 2023. Normative Reference Values and Predicting Factors of Handgrip Strength For Dominant and Non-Dominant Hands Among Healthy Malay Adults in Malaysia. BMC Musculoskelet Disord, 24, pp. 1-9. doi: 10.1186/s12891-023-06181-8.

Joo, K.C., Son, D.H., & Park, J.M., 2022. Association Between Relative Handgrip Strength and Insulin Resistance in Korean Elderly Men Without Diabetes: Findings Of The 2015 Korea National Health Nutrition Examination Survey. Korean J Fam Med, 43, pp.199-205. doi:10.4082/kjfm.21.0138.

Krakauer, N.Y., & Krakauer, J.C., 2020. Association of Body Shape Index (ABSI) with Hand Grip Strength. Int J Environ Res Public Health,17, pp.1-12. doi: doi:10.3390/ijerph17186797.

Kurniawan, A., Widjaja, D., & Lugito, N.P.H., 2018. Mean and Cutoff Value of Hand Grip Strength For Healthy Indonesian Young Adults. World Congress on Osteoporosis, Osteoartritis and Musculoskeletal Diseases; Krakow, Poland.

Leong, D.P., Teo, K.K., Rangarajan, S., Kutty, R., Lanas, F., Hui, C., Quanyong, X., Zhenzhen, Q., Jinhua, T., Noorhassim, I., et al., 2016. Reference Ranges of Handgrip Strength From 125,462 Healthy Adults in 21 Countries: A Prospective Urban Rural Epidemiologic (PURE) Study. J Cachexia Sarcopenia Muscle,7, pp.535-546. doi: 10.1002/jcsm.12112.

Mainous, A.G., Tanner, R.J., Anton, S.D., & Jo, A., 2015. Grip Strength as A Marker of Hypertension and Diabetes in Healthy Weight Adults. Am J Prev Med, 49(6): pp.850-858. doi: 10.1016/j.amepre.2015.05.025.

Manoharan, V.S., Sundaram, S.G., & Jason, J.I., 2015. Factors Affecting Hand Grip Strength and Its Evaluation: A Systemic Review. Int J Physiother Res, 3(6): pp.1288-1293. doi:10.16965/ijpr.2015.193.

McGrath, R., Johnson, N., Klawitter, L., Mahoney, S., Trautman, K., Carlson, C., Rockstad, E., & Hackney, K.J., 2020. What Are The Association Patterns Between Handgrip Strength and Adverse Health Conditions? A Topical Review. SAGE Open Medicine, 8, pp.1-12. doi:10.1177/2050312120910358.

Nakanishi, S., Shimoda, M., Kimura, T., Sanada, J., Fushimi, Y., Iwamoto, Y., Iwamoto, H., Dan, K., Mune, T., Kaku, K., et al., 2024. The Impact of Handgrip Strength and Waist Circumference on Glycemic Control: Prospective, Observational Study Using Outpatient Clinical Data in Japanese Patients With Type 2 Diabetes Mellitus. J Diabetes Investig, 15(7): pp.892-898. doi: 10.1111/jdi.14200.

Nathania, N.P.S., Nugraha, M.H.S., Primayanti, I.D.A., & Saraswati, P.A.S., 2023. Handgrip Strength is Associated With Balance in Elderly Women. Majalah Ilmiah Fisioterapi Indonesia, 11, pp.70-75.

Peraturan Gubernur Provinsi Daerah Khusus Ibukota Jakarta Nomor 7 tahun 2017 Tentang Penanganan Prasarana dan Sarana Umum Tingkat Kelurahan. Jakarta 2017.

Richter, E.A., & Hargreaves, M., 2013. Exercise, GLUT4, and Skeletal Muscle Glucose Uptake. Physiol Rev, 93(3): pp.993-1017. doi: 10.1152/physrev.00038.2012.

Rokhmah, F.D., Handayani, D., & Al-Rasyid, H., 2015. Korelasi Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul Terhadap Kadar Glukosa Plasma Menggunakan Tes Toleransi Glukosa Oral. Jurnal Gizi Klinik Indonesia,12, pp.28-35.

Schrager, M.A., Metter, E.J., Simonsick, E., Ble, A., Bandinelli, S., Lauretani, F., & Ferrucci, L., 2007. Sarcopenic Obesity and Inflammation in The Inchianti Study. J Appl Physiol, 102(3): pp.919-925. doi: 10.1152/japplphysiol.00627.2006.

Sirajudeen, M.S., Shah, U.N., Pillai, P.S., Mohasin, N., & Shantaram, M., 2012. Correlation Between Grip Strength and Physical Factors in Men. International Journal of Health and Rehabilitation Sciences, 1, pp.58-63.

Soraya, N., & Parwanto, E., 2023. The Controversial Relationship Between Body Mass Index and Handgrip Strength in The Elderly: An Overview. Malays J Med Sci, 30, pp.73-83.

Vaishya, R., Misra, A., Vaish, A., Ursino, N., & D'Ambrosi, R., 2024. Hand Grip Strength as A Proposed New Vital Sign Of Health: A Narrative Review of Evidences. Journal of Health, Population and Nutrition, 43, pp.1-14. doi:10.1186/s41043-024-00500-y.

Widjaja, D., Tjhai, K., Dermawan, K., Kalim, J., Tanzil, S., Pramusinta, A., Phenca, H.K., Kurniawan, A., 2018. Correlations Between Hand Grip Strength and Anthropometric Status in Young Indonesian Adults. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.

Zaccagni, L., Toselli, S., Bramanti, B., Gualdi-Russo, E., Mongillo, J., & Rinaldo, N., 2020. Handgrip Strength in Young Adults: Association With Anthropometric Variables and Laterality. Int J Environ Res Public Health, 17, pp.1-18. doi:10.3390/ijerph17124273.

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Factors Associated With Handgrip Strength of Public Works Personnel in West Jakarta

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Abstract

Public Works Personnel (PWP) in Jakarta perform their routine duties manually instead of using equipment. Handgrip strength (HGS) measures maximum hand strength as a quality indicator for muscle strength and mass. Factors affecting muscle strength are age, sex, body mass index (BMI), waist circumference (WC), and hip circumference (HC). Increased fasting blood glucose (FBG) is also associated with muscle quality, muscle strength, and physical performance. This study aimed to determine the factors associated with handgrip strength in PWP. A total of 192 male PWP from the Cengkareng district were recruited by simple random sampling. Collected data were demographics, BMI, FBG, WC, HC, and HGS. Statistical analysis was done using Pearson's correlation test and multiple regression analysis. There was a significant positive correlation of BMI, WC, and HC with HGS ($p=0.006$; $r=0.20$, $p=0.009$; $r=0.19$ and $p=0.005$; $r=0.20$) and a significant negative correlation between age and HGS ($p=0.008$; $r=-0.19$) but not between FBG and HGS ($p=0.847$). Multiple regression analysis showed height, BMI, and HC positively predicting HGS ($R^2=0.19$). Handgrip strength of public works personnel is associated with BMI, age, waist circumference, and hip circumference, but not with fasting blood glucose. Height, BMI, and hip circumference predict handgrip strength.

Keywords: Handgrip strength, Body mass index, Hip circumference, Waist circumference, Fasting blood glucose

INTRODUCTION

Personnel for the management of public infrastructure and facilities at the village level are workers who manage village public works for a given time period on the basis of a work order. The tasks of village-level public works personnel (PWP) consist of managing the infrastructure and facilities, such as streets, drains, and parks, including installed lights (Peraturan Gubernur DKI Jakarta, 2017). The work performed by village PWP consists mainly of intense physical activity involving the hands, such that handgrip strength is essential in their tasks. Lowering of handgrip strength may indicate reduced muscle strength, which may especially interfere with the daily activities of village PWP that consist mainly of manual labor.

Handgrip strength measures maximal hand strength and indicates muscle quality that reflects muscle strength and mass. Muscle strength refers to the ability of muscle groups to raise a given load. Low or poor grip strength is frequently associated with damaging health impacts, such as chronic disease, and is the initial sign of reduced muscle mass, limitations in physical functions, and mortality risk. Poor handgrip strength may also reduce a person's ability to perform activities of daily living and, therefore, impact quality of life (Soraya et al., 2023; Nathania et al., 2023). Muscle mass accounts for approximately 40% of total weight, such that knowledge of muscle mass conditions is essential in maintaining health and activities (Handayani et al,. 2018).

Handgrip strength may represent the strength of all muscles in the body. Several factors possibly influencing an individual's muscle strength are age, sex, and body mass index (BMI) (Soraya et al., 2023). Obesity may also affect BMI. Obesity in adults is not only associated with genetic factors but also with environmental factors during development (Fauzi et al., 2022). Handgrip strength is also associated with chronic diseases such as diabetes, metabolic syndrome, and cardiovascular disease. Increased glucose concentration is also associated with disorders of muscle quality and strength, as well as physical performance (Chen et al., 2023). A reduction in muscle mass also affects an individual's strength and physical endurance. A combination of proteins is considered to be able to maintain muscle function, thereby building body strength and physical endurance (Soenyoto et al., 2017). In the present study, we included fasting blood glucose concentrations in the data collection in order to obtain more accurate measures of glucose concentrations that have not yet been influenced by food intake.

Handgrip strength may be a health indicator that provides information on a person's health (Vaishya et al., 2024). However, its clinical significance in determining the prevention and treatment of poor handgrip remains limited because of the still unclear etiology of muscle weakness, especially because the clinical outcomes associated with handgrip strength are extremely diverse (Mc Grath et al., 2020). The relationship between BMI and handgrip strength is still controversial, with several investigators finding a significant positive association and others reporting a non-significant relationship (Al Asadi, 2018).

There are few studies on handgrip strength, especially on workers in the sanitation sector such as public works personnel, such that the present investigators were interested in studying this topic. The aim of the present study was to determine the factors associated with handgrip strength in public works personnel.

METHOD

This cross-sectional study involving male public works personnel in Cengkareng District, West Jakarta, was conducted from September to October 2024. The study sample was selected by simple random sampling. Calculation of the sample size for a correlation with r=0.2, Zα=0.05, and Zβ=0.1, resulted in a sample of 192 subjects who met the inclusion criterion of being male and 25-60 years old, and the exclusion criteria of having an abnormality of the hands, heart disease, pulmonary disease, and malignancies.

Measurements were obtained on height in cm, weight in kg, as well as waist circumference and hip circumference in cm. Height and weight were determined using microtoise and digital scales, respectively. BMI was calculated using the formula of weight divided by height squared. Measurement of waist and hip circumferences was done using measuring tape. Waist circumference was determined with the subject in the upright position, at the end of a normal expiration, at the smallest abdominal circumference between the iliac crest and twelfth rib. The cut-off values for waist circumference in males and females are ≥ 90 cm and ≥ 80 cm, respectively. Hip circumference was measured using measuring tape that was applied around the hips at the level of the symphysis pubis and the maximal gluteal circumference (Rokhmah et al., 2015; Ilmi et al., 2020).

Fasting blood glucose (FBG) concentration was determined on venous blood by the hexokinase method after the respondents had fasted approximately 10 hours prior. Handgrip strength was measured with a handgrip strength dynamometer to the nearest kilogram as follows: The respondent was asked to sit down comfortably without reclining and with the feet completely relaxed. The hips and knees were positioned at a 90^0 angle, the gripping hand with the shoulder in adduction, the elbow flexed 90^0, and the forearm and wrist in the neutral position. The gripping duration was 3 seconds. The respondent gripped the instrument with the dominant hand as hard as possible and the value indicated by the needle was recorded. In accordance with the protocol recommended by the American Society of Hand Therapists (ASHT), the recorded handgrip strength was the average of three handgrip strength tests (Nathania et al., 2023).

Prior to data analysis by means of the correlation test, the normality of the data distribution was determined using the Kolmogorov-Smirnov test. The Pearson correlation test was used for a normal data distribution, whereas for a non-normal data distribution, the Spearman correlation test was done, followed by a multiple regression analysis.

Ethics approval was issued by the Ethics Committee of the Faculty of Medicine, Universitas Trisakti, under No. 033/KER/FK/08/2024.

RESULT AND DISCUSSION

In this study the respondents comprised 192 male public works personnel of Cengkareng District that consisted of the villages (subdistricts) of Kedaung, Duri Kosambi, West Cengkareng, Kapuk, and Rawa Buaya. A total of 26% of the respondents were residents of Duri Kosambi, where Muslims comprised 98.4% of the population. The majority of the respondents at 77.6% had an educational level of senior high school, nearly all of the respondents, or 99%, were right-handed, using the right hand as the dominant one at work, and most were of the Betawi (Jakarta) ethnic group at 51.6% (Table 1).

Table 1. Demographic data of the respondents

Characteristic	N (%)
Village	
Kedaung	40 (20.8)
Duri Kosambi	50 (26)
Cengkareng Barat	33 (17.2)
Kapuk	43 (22.4)
Rawa Buaya	26 (13.5)
Religion	
Islamic	189 (98.4)
Christian	2 (1)
Catholic	1 (0.5)
Level of education	
Elementary school	7 (3.6)
Junior high school	29 (15.1)
Senior high school	149 (77.6)
Academy-University	7 (3.6)
Dominant hand	
Right hand	190 (99)
Left hand	2 (1)
Ethnic group	
Javanese	53 (27.6)
Betawi	99 (51.6)
Sundanese	25 (13)
Other	14 (7.3)

Legend: Other ethnicities comprised groups from Palembang, Lampung, Bima, and Kupang
Source: primary data (questionnaires and interviews with respondents)

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Table 2. Respondents' characteristics

Variable	Mean ± SD
Age (years)	40.9 ± 8.9
Height (cm)	164.6 ± 6.7
Weight (kg)	64.7 ± 13.1
BMI (kg/m^2)	23.8 ± 4.3
Waist circumference (cm)	85.4 ± 10.4
Hip circumference (cm)	96.9 ± 8.4
HGS (kg)	33.1 ± 6.9
FBG (mg/dL)	87 (64-280)*

Legend: BMI: body mass index. *FBG: fasting blood glucose, expressed as Median (Min-Max).
HGS: handgrip strength
Source: primary data (respondents' measurements)

The bivariate analysis found a significant positive correlation of BMI, height, weight, waist circumference, and hip circumference with handgrip strength (p=0.006, r=0.20; p=<0.001, r=0.36; p=<0.001, r=0.32; p=0.009, r=0.19; p= 0.005; r=0.20, respectively). This showed that the larger the BMI, height, weight, waist circumference, and hip circumference, the stronger the handgrip. However, there was no significant relationship between fasting glucose concentration and handgrip strength (p=0.847). This study also found that age had a significant negative correlation with handgrip strength (p=0.011; r= -0.182), signifying that the older a person, the lower the handgrip strength (Table 3). Results of multiple regression analysis on handgrip strength are listed in Table 4.

Table 3. Analysis of the relationship of age, height, weight, BMI, waist circumference, hip circumference, and fasting blood glucose concentration with handgrip strength

Variable	R	P value
Age	- 0.19	0.008*
Height	0.36	0.000*
Weight	0.32	0.000*
BMI	0.20	0.006*
Waist circumference	0.19	0.009*
Hip circumference	0.20	0.005*
FBG	0.02	0.847#

*P value with Pearson's test, # Spearman's test
Source: primary data

Table 4. Multiple regression analysis on handgrip strength

Determinant	b	SE	p
Height	0.48	0.08	0.000
BMI	0.79	0.22	0.000
Hip circumference	- 0.29	0.12	0.015
Constant	- 36.98		

R^2=0,19

Source: primary data

This study found that most of the public works personnel in Duri Kosambi village were Muslims, had a senior high school level of education, and were of Betawi ethnicity. This was in line with the demographic data in Cengkareng district, in that Duri Kosambi was the village with the greatest area, the majority of the residents were male, and the Islamic religion had the most believers (Badan Pusat Statistik Jakarta Barat, 2020). Among our respondents, more than ten percent were in the diabetes category. Socio-demographic factors capable of affecting dietary habits in patients with diabetes are level of education and type of family (Rondhianto et al., 2024). Among the respondents of this study, the dominant right hand was used for working. In the adult population, a total of 90% of the residents preferred to use the right hand for manual tasks, whereas around 10% used the left hand (Zaccagni et al., 2020). According to Agtuahene et al. (Agtuahene et al., 2023), the dominant hand is generally around 10% stronger than the non-dominant hand. Many activities in daily life need a high level of exertion of the muscles of the hand and forearm (Hammed et al., 2017). The frequent use of the dominant hand in daily living results in the muscles of the hand and forearm providing strength in gripping (Afaq et al., 2019).

The mean handgrip strength in this study was 33.1 ± 6.9 kg, which is relatively low if compared with the study results of Kurniawan et al. (Kurniawan et al., 2018). in healthy young Indonesian adults, where mean handgrip strength in males was 37.37 ± 8.29 kg and the lower limit of muscle strength in Indonesian males was 20.79 kg. The handgrip strength results in both studies are still below those of males in other Southeast Asian countries, according to the study results of Leong et al. (Leong et al., 2016). These investigators found that the mean handgrip strength in Southeast Asian males aged 35-40 years was 40 kg (34-44 kg); for the age range of 41-50 years, the handgrip strength was 38 kg (33-44 kg), for the age range of 51-60 years it was 34 kg (30-40 kg), and for ages 61-70 years 30 kg (24-34 kg). This may have been caused by ethnic differences mediated by genetic differences that also affect individual muscle strength. The highest handgrip strength is found in the European and North American populations, whereas the lowest handgrip strength is found in African, South Asian, and Southeast Asian populations. These variations in muscle strength in various countries may also be partly caused by differences in socio-economic status (Leong et al., 2016).

According to Agtuahene et al. (Agtuahene et al., 2023), handgrip strength is a physiological variable influenced by several factors, such as age, sex, and body measurements. In contrast, according to Zaccagni et al. (Zaccagni et al., 2020), handgrip strength, apart from being affected by age, may also be influenced by physical activity, grip measurement, height, and body mass. The present study found a significant positive correlation between BMI and handgrip strength. According to Hammed et al., this may be caused by the higher percentage of skeletal muscle mass compared to the percentage of fat mass, thereby resulting in a higher handgrip strength [13]. Our study's results are identical to those of Agtuahene et al. (Agtuahene et al., 2023), who found a

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significant positive correlation (r= 0.290) of handgrip strength with BMI and height. This shows that taller individuals with higher BMI apparently have greater handgrip strength. Our study is also in line with the study of Krakauer in 2020, which showed a positive correlation between BMI and handgrip strength (Krakauer et al., 2020).

The study of Cooper et al. (Cooper et al., 2022) concluded that a high childhood BMI is associated with higher grip strength at age 46 years. This is because fat mass acts as a mechanical load that elicits an anabolic response that stimulates muscle growth and function. This anabolic response is usually greater in males than in females because of the higher testosterone concentration in males. However, it should also be noted that BMI does not differentiate between fat mass and lean mass as adipocyte indicators that may vary with sex. It should be noted that BMI is a measure of body fat that does not differentiate between weight changes as a result of an increase or decrease in muscle mass or body fat (Zaccagni et al., 2020). According to Jafar et al. (Jaafar et al., 2023), heavier individuals have a greater muscle mass, resulting in greater handgrip strength, than lighter individuals. In the study of Heidy et al. (Heidy et al., 2019), the investigators found a positive correlation between height and forearm length. The study by Sirajudeen et al. (Sirajudeen et al., 2012) found a positive correlation between hand length and handgrip strength. This shows that height affects the longer extremity or arm, thus approaching optimal muscle length that may result in greater grip strength. According to a prospective cohort study, handgrip strength in middle age appears to be associated with birth weight and the increase in height at puberty. Pubertal growth and handgrip strength possibly represent the development of muscle size and growth (Schrager et al., 2007).

Our study found no relationship between blood glucose concentration and handgrip strength. Our study agrees with the study of Giglio et al. (Giglio et al., 2018), which showed no significant relationship between muscle mass strength and blood glucose concentration. According to Giglio, this is because most respondents are individuals who routinely perform structured physical activity, even though they are in the light category. This is similar to our study respondents, who were public works personnel and who had performed physical activity such as street sweeping and cleaning storm drains. Glucose is the main fuel for muscle contraction, entering the muscle cells by diffusion through the GLUT4 glucose transporter, which, after muscle contraction, moves from its intracellular storage site to the plasma membrane and T-tubules (Richter et al., 2013). Glucose metabolism has an influence on handgrip strength through various mechanisms, such as disorders of glucose metabolism, particularly glycogenolysis, that may result in the loss of muscle strength. Insulin resistance in hyperglycemia may cause muscle degradation because hyperglycemia causes low muscle strength through effects on skeletal muscle mitochondria. The lowering of muscle strength by hyperglycemia occurs through Krüppel-like factor 15, which regulates skeletal muscle lipid flux. Hyperglycemia also increases pro-inflammatory cytokines, which may increase the catabolism that plays a role in the further decrease in muscle mass and quality (Gamayanti et al., 2023). The amount of carbohydrates also influences the glycemic response and post-prandial insulin level, impacting the supply of glycogen to the muscles (Safitri et al.,2020).

This study has a significant negative correlation between age and handgrip strength, which decreases with age (Manoharan et al., 2015). Handgrip strength initially experiences an increase with increasing age, reaches its peak between the age of 30 and 40 years, and decreases afterward (Zaccagni et al., 2020). The age-related changes in skeletal muscle composition, particularly the accumulation of lipids in skeletal muscle fibers, play a role in the poor quality of the muscles and may result in metabolic abnormalities such as insulin resistance. Apart from changes in muscle

quality, there is also a reduction in muscle mass that is consistently occurring during aging. The increase in oxidative stress and chronic inflammation that commonly occurs in the aging process apparently also plays a role in the development of decreased muscle mass and strength (Mainous et al., 2015). The decrease in muscle mass in the elderly corresponds to a 10% reduction in grip strength per decade, starting from the age of 40 years (Jaafar et al., 2023). Skeletal muscle plays an important role in glucose metabolism and has a significant influence on insulin sensitivity. Increased insulin resistance in older adults may be closely associated with skeletal muscle aging. A reduction in GLUT4 expression as a result of a decrease in muscle volume causes a reduction in insulin sensitivity in aging skeletal muscle (Joo et al., 2022).

The results of this study showed a correlation of waist circumference and hip circumference with handgrip strength. This is in line with the study of Widjaja et al. (Widjaja et al., 2018), who stated that there was a significant correlation of waist circumference and hip circumference with handgrip strength ($p=<0.001$, $r=0.302$; and $p=<0.001$, $r=0.296$) A greater waist circumference is associated with a greater handgrip strength in males (Hardy et al., 2013).

In the multiple regression analysis of HGS, we removed the data on body weight because of the occurrence of multicollinearity between weight and BMI, with a correlation coefficient of more than 0.9, indicating an extremely strong relationship between these two variables. Conceptually, only one of the variables is used in multivariate analysis. The multiple regression analysis included age, height, BMI, waist circumference, and hip circumference, with HGS as dependent variable in a stepwise dependent manner. After three iterations, only height, BMI, and hip circumference played a role in predicting HGS by means of the regression formula, which resulted in $R^2=0.19$. This signifies that for known values of height, BMI, and hip circumference, we can predict the HGS value 19% more accurately than without a knowledge of these data. For a clinical diagnosis, a minimum increase of 10% is needed. This study found that height, BMI, and hip circumference play a role in predicting handgrip strength through the regression formula, i.e., handgrip strength = - 36.98 + 0.48 x height + 0.79 x BMI – 0.29 x hip circumference. Handgrip strength and waist circumference are surrogate muscle strength and visceral adiposity markers, respectively (Nakanishi et al., 2024). Waist circumference is also more sensitive in determining body fat distribution, particularly in the abdomen. Waist circumference correlates better with abdominal fat distribution than BMI (Rokhmah et al., 2015). Waist circumference and hip circumference are associated with obesity, in which the fat content is higher, and the skeletal muscle and fascicular content is lower, thereby resulting in a lower contractile capacity of skeletal muscle (Afaq et al., 2019).

The limitation of this study is that it did not evaluate other factors that may affect handgrip strength, such as nutrient intake. From the anthropometric measures of the hands and feet in this study, the causes and effects of the decrease in handgrip strength could not be determined because this study used a cross-sectional design.

CONCLUSION

There are three factors that may be used to estimate handgrip strength in PWP, namely height, BMI, and hip circumference, whereas blood glucose concentration is not correlated with handgrip strength in PWP. It is recommended to pay attention to height, BMI, and hip circumference,

particularly in the acceptance criteria of PWP candidates, and to conduct further studies with consideration of other factors that affect handgrip strength, such as food intake and anthropometric features of the hands and arms.

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REFERENCES

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Afaq, E., Hassan, S.H., Khan, M.R., Zaidi, D.A., & Baktashi, H., 2019. Correlation of Hand Dynamometry With Body Mass Index and Waist Hip Ratio in Medical Students. Pak J Physiol,15, pp.19-21.

Agtuahene, M.A., Quartey, J., & Kwakye, S., 2023. Influence of Hand Dominance, Gender, and Body Mass Index on Hand Grip Strength. S Afr J Physiother, 79, pp.1-6. doi: org/10.4102/sajp.v79i1.1923.

Al-Asadi, J.N., 2018. Handgrip Strength in Medical Students: Correlation with Body Mass Index and Hand Dimensions. Asian Journal of Medical Sciences, 9, pp.21-26. doi: 10.3126/ajms.v9i1.18577.

Badan Pusat Statistik Kota Administrasi Jakarta Barat., 2020. Kecamatan Cengkareng Dalam Angka, pp. 1-114.

Chen, D., Zhu, Y., Ni, W., Li, Y., Yin, G., Shao, Z., & Zhu, J., 2023. Hand Grip Strength is Inversely Associated with Total Daily Insulin Dose Requirement in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study. PeerJ, pp.1-13. doi: 10.7717/peerj.15761.

Cooper, R., Tomlinson, D., Hamer, M., & Pereira, S.M.P., 2022. Lifetime Body Mass Index and Grip Strength at Age 46 Years: The 1970 British Cohort Study. J Cachexia Sarcopenia Muscle, 13, pp.1-10. doi: 10.1002/jcsm.12992.

Fauzi, L., Handayani, O.W.K., Susilo, M.T., Kurnia, A.R., Rahayu, S.R., Irawan, F.A., Horng Lu, F.J., Lin, C., Lai, M.F., & Yu, Y.C., 2022. Obesity in Indonesian and Taiwanese Adolescents Related to Self Perception, Diet, Exercise and Body Image. KEMAS, 17(3):pp.453-461. doi: 10.15294/kemas.v17i3.34396

Gamayanti, K.A.V., Aryana, I.G.P.S., & Gotera, W., 2023. Hubungan Antara Kekuatan Genggaman Tangan Dengan Kadar Gula Darah Sewaktu Pada Lansia Di Desa Melinggih, Kecamatan Payangan, Kabupaten Gianyar. Intisari Sains Medis, 14(2): pp.483-488.

Giglio, B.M., Mota, J.F., Wall, B.T., & Pimentel, G.D., 2018. Low Handgrip Strength is Not Associated With Type 2 Diabetes Mellitus and Hyperglycemia: A Population-Based Study. Clin Nutr Res, 7(2): pp.112-116. doi: 10.7762/cnr.2018.7.2.112.

Hammed, A.I., & Obaseki, C.O., 2017. Interdependence of Body Mass Index with Handgrip Strength and Endurance Among Apparently Healthy Teenagers. Turk J Kin, 4, pp.1-7.

Handayani, M.D.N., Sadewa, A.H., Farmawati, A., & Rochmah, W., 2018. Anthropometric Prediction Equations for Estimating Muscle Mass of Elderly Women. KEMAS, 14(2):pp.195-204. doi: 10.15294/kemas.v14i2.14073

Hardy, R., Cooper, R., Sayer, A.A., Shlomo, Y.B., Cooper, C., Deary, I.J., Demakakos, P., Gallacher, J., Martin, R.M., McNeill, G., et al., 2013. Body Mass Index, Muscle Strength and Physical Performance in Older Adults From Eight Cohort Studies: The Halcyon Programme. PLoS One, 8(2): pp.e56483. doi: 10.1371/journal.pone.0056483.

Heidy., Djuartina, T., & Irawan, R., 2019. Korelasi Kekuatan Genggaman Tangan Dengan Karakter Antropometri Lengan Bawah dan Tangan Serta Indeks Massa Tubuh. Damianus Journal of Medicine,18, pp.1-7.

Ilmi, A.F., & Utari, D.M., 2020. Hubungan Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul (RLPP) Terhadap Kadar Glukosa Darah Puasa Pada Mahasiswa. Journal of Nutrition College, 9, pp.222-227.

Jaafar, M.H., Ismail, R., Ismail, N.H., Isa, Z.M., Tamil, A.M., Nasir, N.M., Keat, N.K., Razak, N.H., Abidin, N.Z., & Yusof, K.H., 2023. Normative Reference Values and Predicting Factors of Handgrip Strength For Dominant and Non-Dominant Hands Among Healthy Malay Adults in Malaysia. BMC Musculoskelet Disord, 24, pp. 1-9. doi: 10.1186/s12891-023-06181-8.

Joo, K.C., Son, D.H., & Park, J.M., 2022. Association Between Relative Handgrip Strength and Insulin Resistance in Korean Elderly Men Without Diabetes: Findings Of The 2015 Korea National Health Nutrition Examination Survey. Korean J Fam Med, 43, pp.199-205. doi:10.4082/kjfm.21.0138.

Krakauer, N.Y., & Krakauer, J.C., 2020. Association of Body Shape Index (ABSI) with Hand Grip Strength. Int J Environ Res Public Health,17, pp.1-12. doi: doi:10.3390/ijerph17186797.

Kurniawan, A., Widjaja, D., & Lugito, N.P.H., 2018. Mean and Cutoff Value of Hand Grip Strength For Healthy Indonesian Young Adults. World Congress on Osteoporosis, Osteoartritis and Musculoskeletal Diseases; Krakow, Poland.

Leong, D.P., Teo, K.K., Rangarajan, S., Kutty, R., Lanas, F., Hui, C., Quanyong, X., Zhenzhen, Q., Jinhua, T., Noorhassim, I., et al., 2016. Reference Ranges of Handgrip Strength From 125,462 Healthy Adults in 21 Countries: A Prospective Urban Rural Epidemiologic (PURE) Study. J Cachexia Sarcopenia Muscle,7, pp.535-546. doi: 10.1002/jcsm.12112.

Mainous, A.G., Tanner, R.J., Anton, S.D., & Jo, A., 2015. Grip Strength as A Marker of Hypertension and Diabetes in Healthy Weight Adults. Am J Prev Med, 49(6): pp.850-858. doi: 10.1016/j.amepre.2015.05.025.

Manoharan, V.S., Sundaram, S.G., & Jason, J.I., 2015. Factors Affecting Hand Grip Strength and Its Evaluation: A Systemic Review. Int J Physiother Res, 3(6): pp.1288-1293. doi:10.16965/ijpr.2015.193.

McGrath, R., Johnson, N., Klawitter, L., Mahoney, S., Trautman, K., Carlson, C., Rockstad, E., & Hackney, K.J., 2020. What Are The Association Patterns Between Handgrip Strength and Adverse Health Conditions? A Topical Review. SAGE Open Medicine, 8, pp.1-12. doi:10.1177/2050312120910358.

Nakanishi, S., Shimoda, M., Kimura, T., Sanada, J., Fushimi, Y., Iwamoto, Y., Iwamoto, H., Dan, K., Mune, T., Kaku, K., et al., 2024. The Impact of Handgrip Strength and Waist Circumference on Glycemic Control: Prospective, Observational Study Using Outpatient Clinical Data in Japanese Patients With Type 2 Diabetes Mellitus. J Diabetes Investig, 15(7): pp.892-898. doi: 10.1111/jdi.14200.

Nathania, N.P.S., Nugraha, M.H.S., Primayanti, I.D.A., & Saraswati, P.A.S., 2023. Handgrip Strength is Associated With Balance in Elderly Women. Majalah Ilmiah Fisioterapi Indonesia, 11, pp.70-75.

Peraturan Gubernur Provinsi Daerah Khusus Ibukota Jakarta Nomor 7 tahun 2017 Tentang Penanganan Prasarana dan Sarana Umum Tingkat Kelurahan. Jakarta 2017.

Richter, E.A., & Hargreaves, M., 2013. Exercise, GLUT4, and Skeletal Muscle Glucose Uptake. Physiol Rev, 93(3): pp.993-1017. doi: 10.1152/physrev.00038.2012.

Rokhmah, F.D., Handayani, D., & Al-Rasyid, H., 2015. Korelasi Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul Terhadap Kadar Glukosa Plasma Menggunakan Tes Toleransi Glukosa Oral. Jurnal Gizi Klinik Indonesia,12, pp.28-35.

Rondhianto., Ridla, A.Z., & Hasan, H., 2024. Sociodemographic Factors Affecting Diabetic Dietary Behavior in People with Type 2 Diabetes Mellitus. KEMAS, 19(3):pp.429-437. doi: 10.15294/kemas.v19i3.37856

Safitri, I., Setyarsih, L., Susanto, H., Suhartono., & Fitranti, D.Y., 2020. The Effect of Low and High Glycemic Load Diet on Muscle Fatigue of Young Soccer. KEMAS, 16(1):pp.111-120. doi: 10.15294/kemas.v16i1.23508

Schrager, M.A., Metter, E.J., Simonsick, E., Ble, A., Bandinelli, S., Lauretani, F., & Ferrucci, L., 2007. Sarcopenic Obesity and Inflammation in The Inchianti Study. J Appl Physiol, 102(3): pp.919-925. doi: 10.1152/japplphysiol.00627.2006.

Sirajudeen, M.S., Shah, U.N., Pillai, P.S., Mohasin, N., & Shantaram, M., 2012. Correlation Between Grip Strength and Physical Factors in Men. International Journal of Health and Rehabilitation Sciences, 1, pp.58-63.

Soenyoto, T., Mollap, K., & Mungpong, J., 2017. Correlation of Energy and Protein Consumption Levels with Physical Endurance of Rhythmic Gymnast Athletes. KEMAS, 13(1):pp.131-136. doi: 10.15294/kemas.v13i1.9888

Soraya, N., & Parwanto, E., 2023. The Controversial Relationship Between Body Mass Index and Handgrip Strength in The Elderly: An Overview. Malays J Med Sci, 30, pp.73-83.

Vaishya, R., Misra, A., Vaish, A., Ursino, N., & D'Ambrosi, R., 2024. Hand Grip Strength as A Proposed New Vital Sign Of Health: A Narrative Review of Evidences. Journal of Health, Population and Nutrition, 43, pp.1-14. doi:10.1186/s41043-024-00500-y.

Widjaja, D., Tjhai, K., Dermawan, K., Kalim, J., Tanzil, S., Pramusinta, A., Phenca, H.K., Kurniawan, A., 2018. Correlations Between Hand Grip Strength and Anthropometric Status in Young Indonesian Adults. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.

Zaccagni, L., Toselli, S., Bramanti, B., Gualdi-Russo, E., Mongillo, J., & Rinaldo, N., 2020. Handgrip Strength in Young Adults: Association With Anthropometric Variables and Laterality. Int J Environ Res Public Health, 17, pp.1-18. doi:10.3390/ijerph17124273.

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Factors Associated With Handgrip Strength of Public Works Personnel in West Jakarta

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Abstract

Public Works Personnel (PWP) in Jakarta perform their routine duties manually instead of using equipment. Handgrip strength (HGS) measures maximum hand strength as a quality indicator for muscle strength and mass. Factors affecting muscle strength are age, sex, body mass index (BMI), waist circumference (WC), and hip circumference (HC). Increased fasting blood glucose (FBG) is also associated with muscle quality, muscle strength, and physical performance. This study aimed to determine the factors associated with handgrip strength in PWP. A total of 192 male PWP from the Cengkareng district were recruited by simple random sampling. Collected data were demographics, BMI, FBG, WC, HC, and HGS. Statistical analysis was done using Pearson's correlation test and multiple regression analysis. There was a significant positive correlation of BMI, WC, and HC with HGS ($p=0.006$; $r=0.20$, $p=0.009$; $r=0.19$ and $p=0.005$; $r=0.20$) and a significant negative correlation between age and HGS ($p=0.008$; $r=-0.19$) but not between FBG and HGS ($p=0.847$). Multiple regression analysis showed height, BMI, and HC positively predicting HGS ($R^2=0.19$). Handgrip strength of public works personnel is associated with BMI, age, waist circumference, and hip circumference, but not with fasting blood glucose. Height, BMI, and hip circumference predict handgrip strength.

Keywords: Handgrip strength, Body mass index, Hip circumference, Waist circumference, Fasting blood glucose

INTRODUCTION

Personnel for the management of public infrastructure and facilities at the village level are workers who manage village public works for a given time period on the basis of a work order. The tasks of village-level public works personnel (PWP) consist of managing the infrastructure and facilities, such as streets, drains, and parks, including installed lights (Peraturan Gubernur DKI Jakarta, 2017). The work performed by village PWP consists mainly of intense physical activity involving the hands, such that handgrip strength is essential in their tasks. Lowering of handgrip strength may indicate reduced muscle strength, which may especially interfere with the daily activities of village PWP that consist mainly of manual labor.

Handgrip strength measures maximal hand strength and indicates muscle quality that reflects muscle strength and mass. Muscle strength refers to the ability of muscle groups to raise a given load. Low or poor grip strength is frequently associated with damaging health impacts, such as chronic disease, and is the initial sign of reduced muscle mass, limitations in physical functions, and mortality risk. Poor handgrip strength may also reduce a person's ability to perform activities of daily living and, therefore, impact quality of life (Soraya et al., 2023; Nathania et al., 2023). Muscle mass accounts for approximately 40% of total weight, such that knowledge of muscle mass conditions is essential in maintaining health and activities (Handayani et al,. 2018).

Handgrip strength may represent the strength of all muscles in the body. Several factors possibly influencing an individual's muscle strength are age, sex, and body mass index (BMI) (Soraya et al., 2023). Obesity may also affect BMI. Obesity in adults is not only associated with genetic factors but also with environmental factors during development (Fauzi et al., 2022). Handgrip strength is also associated with chronic diseases such as diabetes, metabolic syndrome, and cardiovascular disease. Increased glucose concentration is also associated with disorders of muscle quality and strength, as well as physical performance (Chen et al., 2023). A reduction in muscle mass also affects an individual's strength and physical endurance. A combination of proteins is considered to be able to maintain muscle function, thereby building body strength and physical endurance (Soenyoto et al., 2017). In the present study, we included fasting blood glucose concentrations in the data collection in order to obtain more accurate measures of glucose concentrations that have not yet been influenced by food intake.

Handgrip strength may be a health indicator that provides information on a person's health (Vaishya et al., 2024). However, its clinical significance in determining the prevention and treatment of poor handgrip remains limited because of the still unclear etiology of muscle weakness, especially because the clinical outcomes associated with handgrip strength are extremely diverse (Mc Grath et al., 2020). The relationship between BMI and handgrip strength is still controversial, with several investigators finding a significant positive association and others reporting a non-significant relationship (Al Asadi, 2018).

There are few studies on handgrip strength, especially on workers in the sanitation sector such as public works personnel, such that the present investigators were interested in studying this topic. The aim of the present study was to determine the factors associated with handgrip strength in public works personnel.

METHOD

This cross-sectional study involving male public works personnel in Cengkareng District, West Jakarta, was conducted from September to October 2024. The study sample was selected by simple random sampling. Calculation of the sample size for a correlation with r=0.2, Zα=0.05, and Zβ=0.1, resulted in a sample of 192 subjects who met the inclusion criterion of being male and 25-60 years old, and the exclusion criteria of having an abnormality of the hands, heart disease, pulmonary disease, and malignancies.

Measurements were obtained on height in cm, weight in kg, as well as waist circumference and hip circumference in cm. Height and weight were determined using microtoise and digital scales, respectively. BMI was calculated using the formula of weight divided by height squared. Measurement of waist and hip circumferences was done using measuring tape. Waist circumference was determined with the subject in the upright position, at the end of a normal expiration, at the smallest abdominal circumference between the iliac crest and twelfth rib. The cut-off values for waist circumference in males and females are ≥ 90 cm and ≥ 80 cm, respectively. Hip circumference was measured using measuring tape that was applied around the hips at the level of the symphysis pubis and the maximal gluteal circumference (Rokhmah et al., 2015; Ilmi et al., 2020).

Fasting blood glucose (FBG) concentration was determined on venous blood by the hexokinase method after the respondents had fasted approximately 10 hours prior. Handgrip strength was measured with a handgrip strength dynamometer to the nearest kilogram as follows: The respondent was asked to sit down comfortably without reclining and with the feet completely relaxed. The hips and knees were positioned at a 90^0 angle, the gripping hand with the shoulder in adduction, the elbow flexed 90^0, and the forearm and wrist in the neutral position. The gripping duration was 3 seconds. The respondent gripped the instrument with the dominant hand as hard as possible and the value indicated by the needle was recorded. In accordance with the protocol recommended by the American Society of Hand Therapists (ASHT), the recorded handgrip strength was the average of three handgrip strength tests (Nathania et al., 2023).

Prior to data analysis by means of the correlation test, the normality of the data distribution was determined using the Kolmogorov-Smirnov test. The Pearson correlation test was used for a normal data distribution, whereas for a non-normal data distribution, the Spearman correlation test was done, followed by a multiple regression analysis.

Ethics approval was issued by the Ethics Committee of the Faculty of Medicine, Universitas Trisakti, under No. 033/KER/FK/08/2024.

RESULT AND DISCUSSION

In this study the respondents comprised 192 male public works personnel of Cengkareng District that consisted of the villages (subdistricts) of Kedaung, Duri Kosambi, West Cengkareng, Kapuk, and Rawa Buaya. A total of 26% of the respondents were residents of Duri Kosambi, where Muslims comprised 98.4% of the population. The majority of the respondents at 77.6% had an educational level of senior high school, nearly all of the respondents, or 99%, were right-handed, using the right hand as the dominant one at work, and most were of the Betawi (Jakarta) ethnic group at 51.6% (Table 1).

Table 1. Demographic data of the respondents

Characteristic	N (%)
Village	
Kedaung	40 (20.8)
Duri Kosambi	50 (26)
Cengkareng Barat	33 (17.2)
Kapuk	43 (22.4)
Rawa Buaya	26 (13.5)
Religion	
Islamic	189 (98.4)
Christian	2 (1)
Catholic	1 (0.5)
Level of education	
Elementary school	7 (3.6)
Junior high school	29 (15.1)
Senior high school	149 (77.6)
Academy-University	7 (3.6)
Dominant hand	
Right hand	190 (99)
Left hand	2 (1)
Ethnic group	
Javanese	53 (27.6)
Betawi	99 (51.6)
Sundanese	25 (13)
Other	14 (7.3)

Legend: Other ethnicities comprised groups from Palembang, Lampung, Bima, and Kupang
Source: primary data (questionnaires and interviews with respondents)

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Table 2. Respondents' characteristics

Variable	Mean ± SD
Age (years)	40.9 ± 8.9
Height (cm)	164.6 ± 6.7
Weight (kg)	64.7 ± 13.1
BMI (kg/m^2)	23.8 ± 4.3
Waist circumference (cm)	85.4 ± 10.4
Hip circumference (cm)	96.9 ± 8.4
HGS (kg)	33.1 ± 6.9
FBG (mg/dL)	87 (64-280)*

Legend: BMI: body mass index. *FBG: fasting blood glucose, expressed as Median (Min-Max).
HGS: handgrip strength
Source: primary data (respondents' measurements)

The bivariate analysis found a significant positive correlation of BMI, height, weight, waist circumference, and hip circumference with handgrip strength (p=0.006, r=0.20; p=<0.001, r=0.36; p=<0.001, r=0.32; p=0.009, r=0.19; p= 0.005; r=0.20, respectively). This showed that the larger the BMI, height, weight, waist circumference, and hip circumference, the stronger the handgrip. However, there was no significant relationship between fasting glucose concentration and handgrip strength (p=0.847). This study also found that age had a significant negative correlation with handgrip strength (p=0.011; r= -0.182), signifying that the older a person, the lower the handgrip strength (Table 3). Results of multiple regression analysis on handgrip strength are listed in Table 4.

Table 3. Analysis of the relationship of age, height, weight, BMI, waist circumference, hip circumference, and fasting blood glucose concentration with handgrip strength

Variable	R	P value
Age	- 0.19	0.008*
Height	0.36	0.000*
Weight	0.32	0.000*
BMI	0.20	0.006*
Waist circumference	0.19	0.009*
Hip circumference	0.20	0.005*
FBG	0.02	0.847#

*P value with Pearson's test, # Spearman's test
Source: primary data

Table 4. Multiple regression analysis on handgrip strength

Determinant	b	SE	p
Height	0.48	0.08	0.000
BMI	0.79	0.22	0.000
Hip circumference	- 0.29	0.12	0.015
Constant	- 36.98		

R^2=0,19

Source: primary data

This study found that most of the public works personnel in Duri Kosambi village were Muslims, had a senior high school level of education, and were of Betawi ethnicity. This was in line with the demographic data in Cengkareng district, in that Duri Kosambi was the village with the greatest area, the majority of the residents were male, and the Islamic religion had the most believers (Badan Pusat Statistik Jakarta Barat, 2020). Among our respondents, more than ten percent were in the diabetes category. Socio-demographic factors capable of affecting dietary habits in patients with diabetes are level of education and type of family (Rondhianto et al., 2024). Among the respondents of this study, the dominant right hand was used for working. In the adult population, a total of 90% of the residents preferred to use the right hand for manual tasks, whereas around 10% used the left hand (Zaccagni et al., 2020). According to Agtuahene et al. (Agtuahene et al., 2023), the dominant hand is generally around 10% stronger than the non-dominant hand. Many activities in daily life need a high level of exertion of the muscles of the hand and forearm (Hammed et al., 2017). The frequent use of the dominant hand in daily living results in the muscles of the hand and forearm providing strength in gripping (Afaq et al., 2019).

The mean handgrip strength in this study was 33.1 ± 6.9 kg, which is relatively low if compared with the study results of Kurniawan et al. (Kurniawan et al., 2018). in healthy young Indonesian adults, where mean handgrip strength in males was 37.37 ± 8.29 kg and the lower limit of muscle strength in Indonesian males was 20.79 kg. The handgrip strength results in both studies are still below those of males in other Southeast Asian countries, according to the study results of Leong et al. (Leong et al., 2016). These investigators found that the mean handgrip strength in Southeast Asian males aged 35-40 years was 40 kg (34-44 kg); for the age range of 41-50 years, the handgrip strength was 38 kg (33-44 kg), for the age range of 51-60 years it was 34 kg (30-40 kg), and for ages 61-70 years 30 kg (24-34 kg). This may have been caused by ethnic differences mediated by genetic differences that also affect individual muscle strength. The highest handgrip strength is found in the European and North American populations, whereas the lowest handgrip strength is found in African, South Asian, and Southeast Asian populations. These variations in muscle strength in various countries may also be partly caused by differences in socio-economic status (Leong et al., 2016).

According to Agtuahene et al. (Agtuahene et al., 2023), handgrip strength is a physiological variable influenced by several factors, such as age, sex, and body measurements. In contrast, according to Zaccagni et al. (Zaccagni et al., 2020), handgrip strength, apart from being affected by age, may also be influenced by physical activity, grip measurement, height, and body mass. The present study found a significant positive correlation between BMI and handgrip strength. According to Hammed et al., this may be caused by the higher percentage of skeletal muscle mass compared to the percentage of fat mass, thereby resulting in a higher handgrip strength [13]. Our study's results are identical to those of Agtuahene et al. (Agtuahene et al., 2023), who found a

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significant positive correlation (r= 0.290) of handgrip strength with BMI and height. This shows that taller individuals with higher BMI apparently have greater handgrip strength. Our study is also in line with the study of Krakauer in 2020, which showed a positive correlation between BMI and handgrip strength (Krakauer et al., 2020).

The study of Cooper et al. (Cooper et al., 2022) concluded that a high childhood BMI is associated with higher grip strength at age 46 years. This is because fat mass acts as a mechanical load that elicits an anabolic response that stimulates muscle growth and function. This anabolic response is usually greater in males than in females because of the higher testosterone concentration in males. However, it should also be noted that BMI does not differentiate between fat mass and lean mass as adipocyte indicators that may vary with sex. It should be noted that BMI is a measure of body fat that does not differentiate between weight changes as a result of an increase or decrease in muscle mass or body fat (Zaccagni et al., 2020). According to Jafar et al. (Jaafar et al., 2023), heavier individuals have a greater muscle mass, resulting in greater handgrip strength, than lighter individuals. In the study of Heidy et al. (Heidy et al., 2019), the investigators found a positive correlation between height and forearm length. The study by Sirajudeen et al. (Sirajudeen et al., 2012) found a positive correlation between hand length and handgrip strength. This shows that height affects the longer extremity or arm, thus approaching optimal muscle length that may result in greater grip strength. According to a prospective cohort study, handgrip strength in middle age appears to be associated with birth weight and the increase in height at puberty. Pubertal growth and handgrip strength possibly represent the development of muscle size and growth (Schrager et al., 2007).

Our study found no relationship between blood glucose concentration and handgrip strength. Our study agrees with the study of Giglio et al. (Giglio et al., 2018), which showed no significant relationship between muscle mass strength and blood glucose concentration. According to Giglio, this is because most respondents are individuals who routinely perform structured physical activity, even though they are in the light category. This is similar to our study respondents, who were public works personnel and who had performed physical activity such as street sweeping and cleaning storm drains. Glucose is the main fuel for muscle contraction, entering the muscle cells by diffusion through the GLUT4 glucose transporter, which, after muscle contraction, moves from its intracellular storage site to the plasma membrane and T-tubules (Richter et al., 2013). Glucose metabolism has an influence on handgrip strength through various mechanisms, such as disorders of glucose metabolism, particularly glycogenolysis, that may result in the loss of muscle strength. Insulin resistance in hyperglycemia may cause muscle degradation because hyperglycemia causes low muscle strength through effects on skeletal muscle mitochondria. The lowering of muscle strength by hyperglycemia occurs through Krüppel-like factor 15, which regulates skeletal muscle lipid flux. Hyperglycemia also increases pro-inflammatory cytokines, which may increase the catabolism that plays a role in the further decrease in muscle mass and quality (Gamayanti et al., 2023). The amount of carbohydrates also influences the glycemic response and post-prandial insulin level, impacting the supply of glycogen to the muscles (Safitri et al.,2020).

This study has a significant negative correlation between age and handgrip strength, which decreases with age (Manoharan et al., 2015). Handgrip strength initially experiences an increase with increasing age, reaches its peak between the age of 30 and 40 years, and decreases afterward (Zaccagni et al., 2020). The age-related changes in skeletal muscle composition, particularly the accumulation of lipids in skeletal muscle fibers, play a role in the poor quality of the muscles and may result in metabolic abnormalities such as insulin resistance. Apart from changes in muscle

quality, there is also a reduction in muscle mass that is consistently occurring during aging. The increase in oxidative stress and chronic inflammation that commonly occurs in the aging process apparently also plays a role in the development of decreased muscle mass and strength (Mainous et al., 2015). The decrease in muscle mass in the elderly corresponds to a 10% reduction in grip strength per decade, starting from the age of 40 years (Jaafar et al., 2023). Skeletal muscle plays an important role in glucose metabolism and has a significant influence on insulin sensitivity. Increased insulin resistance in older adults may be closely associated with skeletal muscle aging. A reduction in GLUT4 expression as a result of a decrease in muscle volume causes a reduction in insulin sensitivity in aging skeletal muscle (Joo et al., 2022).

The results of this study showed a correlation of waist circumference and hip circumference with handgrip strength. This is in line with the study of Widjaja et al. (Widjaja et al., 2018), who stated that there was a significant correlation of waist circumference and hip circumference with handgrip strength ($p=<0.001$, $r=0.302$; and $p=<0.001$, $r=0.296$) A greater waist circumference is associated with a greater handgrip strength in males (Hardy et al., 2013).

In the multiple regression analysis of HGS, we removed the data on body weight because of the occurrence of multicollinearity between weight and BMI, with a correlation coefficient of more than 0.9, indicating an extremely strong relationship between these two variables. Conceptually, only one of the variables is used in multivariate analysis. The multiple regression analysis included age, height, BMI, waist circumference, and hip circumference, with HGS as dependent variable in a stepwise dependent manner. After three iterations, only height, BMI, and hip circumference played a role in predicting HGS by means of the regression formula, which resulted in $R^2=0.19$. This signifies that for known values of height, BMI, and hip circumference, we can predict the HGS value 19% more accurately than without a knowledge of these data. For a clinical diagnosis, a minimum increase of 10% is needed. This study found that height, BMI, and hip circumference play a role in predicting handgrip strength through the regression formula, i.e., handgrip strength = - 36.98 + 0.48 x height + 0.79 x BMI – 0.29 x hip circumference. Handgrip strength and waist circumference are surrogate muscle strength and visceral adiposity markers, respectively (Nakanishi et al., 2024). Waist circumference is also more sensitive in determining body fat distribution, particularly in the abdomen. Waist circumference correlates better with abdominal fat distribution than BMI (Rokhmah et al., 2015). Waist circumference and hip circumference are associated with obesity, in which the fat content is higher, and the skeletal muscle and fascicular content is lower, thereby resulting in a lower contractile capacity of skeletal muscle (Afaq et al., 2019).

The limitation of this study is that it did not evaluate other factors that may affect handgrip strength, such as nutrient intake. From the anthropometric measures of the hands and feet in this study, the causes and effects of the decrease in handgrip strength could not be determined because this study used a cross-sectional design.

CONCLUSION

There are three factors that may be used to estimate handgrip strength in PWP, namely height, BMI, and hip circumference, whereas blood glucose concentration is not correlated with handgrip strength in PWP. It is recommended to pay attention to height, BMI, and hip circumference,

particularly in the acceptance criteria of PWP candidates, and to conduct further studies with consideration of other factors that affect handgrip strength, such as food intake and anthropometric features of the hands and arms.

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REFERENCES

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Afaq, E., Hassan, S.H., Khan, M.R., Zaidi, D.A., & Baktashi, H., 2019. Correlation of Hand Dynamometry With Body Mass Index and Waist Hip Ratio in Medical Students. Pak J Physiol,15, pp.19-21.

Agtuahene, M.A., Quartey, J., & Kwakye, S., 2023. Influence of Hand Dominance, Gender, and Body Mass Index on Hand Grip Strength. S Afr J Physiother, 79, pp.1-6. doi: org/10.4102/sajp.v79i1.1923.

Al-Asadi, J.N., 2018. Handgrip Strength in Medical Students: Correlation with Body Mass Index and Hand Dimensions. Asian Journal of Medical Sciences, 9, pp.21-26. doi: 10.3126/ajms.v9i1.18577.

Badan Pusat Statistik Kota Administrasi Jakarta Barat., 2020. Kecamatan Cengkareng Dalam Angka, pp. 1-114.

Chen, D., Zhu, Y., Ni, W., Li, Y., Yin, G., Shao, Z., & Zhu, J., 2023. Hand Grip Strength is Inversely Associated with Total Daily Insulin Dose Requirement in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study. PeerJ, pp.1-13. doi: 10.7717/peerj.15761.

Cooper, R., Tomlinson, D., Hamer, M., & Pereira, S.M.P., 2022. Lifetime Body Mass Index and Grip Strength at Age 46 Years: The 1970 British Cohort Study. J Cachexia Sarcopenia Muscle, 13, pp.1-10. doi: 10.1002/jcsm.12992.

Fauzi, L., Handayani, O.W.K., Susilo, M.T., Kurnia, A.R., Rahayu, S.R., Irawan, F.A., Horng Lu, F.J., Lin, C., Lai, M.F., & Yu, Y.C., 2022. Obesity in Indonesian and Taiwanese Adolescents Related to Self Perception, Diet, Exercise and Body Image. KEMAS, 17(3):pp.453-461. doi: 10.15294/kemas.v17i3.34396

Gamayanti, K.A.V., Aryana, I.G.P.S., & Gotera, W., 2023. Hubungan Antara Kekuatan Genggaman Tangan Dengan Kadar Gula Darah Sewaktu Pada Lansia Di Desa Melinggih, Kecamatan Payangan, Kabupaten Gianyar. Intisari Sains Medis, 14(2): pp.483-488.

Giglio, B.M., Mota, J.F., Wall, B.T., & Pimentel, G.D., 2018. Low Handgrip Strength is Not Associated With Type 2 Diabetes Mellitus and Hyperglycemia: A Population-Based Study. Clin Nutr Res, 7(2): pp.112-116. doi: 10.7762/cnr.2018.7.2.112.

Hammed, A.I., & Obaseki, C.O., 2017. Interdependence of Body Mass Index with Handgrip Strength and Endurance Among Apparently Healthy Teenagers. Turk J Kin, 4, pp.1-7.

Handayani, M.D.N., Sadewa, A.H., Farmawati, A., & Rochmah, W., 2018. Anthropometric Prediction Equations for Estimating Muscle Mass of Elderly Women. KEMAS, 14(2):pp.195-204. doi: 10.15294/kemas.v14i2.14073

Hardy, R., Cooper, R., Sayer, A.A., Shlomo, Y.B., Cooper, C., Deary, I.J., Demakakos, P., Gallacher, J., Martin, R.M., McNeill, G., et al., 2013. Body Mass Index, Muscle Strength and Physical Performance in Older Adults From Eight Cohort Studies: The Halcyon Programme. PLoS One, 8(2): pp.e56483. doi: 10.1371/journal.pone.0056483.

Heidy., Djuartina, T., & Irawan, R., 2019. Korelasi Kekuatan Genggaman Tangan Dengan Karakter Antropometri Lengan Bawah dan Tangan Serta Indeks Massa Tubuh. Damianus Journal of Medicine,18, pp.1-7.

Ilmi, A.F., & Utari, D.M., 2020. Hubungan Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul (RLPP) Terhadap Kadar Glukosa Darah Puasa Pada Mahasiswa. Journal of Nutrition College, 9, pp.222-227.

Jaafar, M.H., Ismail, R., Ismail, N.H., Isa, Z.M., Tamil, A.M., Nasir, N.M., Keat, N.K., Razak, N.H., Abidin, N.Z., & Yusof, K.H., 2023. Normative Reference Values and Predicting Factors of Handgrip Strength For Dominant and Non-Dominant Hands Among Healthy Malay Adults in Malaysia. BMC Musculoskelet Disord, 24, pp. 1-9. doi: 10.1186/s12891-023-06181-8.

Joo, K.C., Son, D.H., & Park, J.M., 2022. Association Between Relative Handgrip Strength and Insulin Resistance in Korean Elderly Men Without Diabetes: Findings Of The 2015 Korea National Health Nutrition Examination Survey. Korean J Fam Med, 43, pp.199-205. doi:10.4082/kjfm.21.0138.

Krakauer, N.Y., & Krakauer, J.C., 2020. Association of Body Shape Index (ABSI) with Hand Grip Strength. Int J Environ Res Public Health,17, pp.1-12. doi: doi:10.3390/ijerph17186797.

Kurniawan, A., Widjaja, D., & Lugito, N.P.H., 2018. Mean and Cutoff Value of Hand Grip Strength For Healthy Indonesian Young Adults. World Congress on Osteoporosis, Osteoartritis and Musculoskeletal Diseases; Krakow, Poland.

Leong, D.P., Teo, K.K., Rangarajan, S., Kutty, R., Lanas, F., Hui, C., Quanyong, X., Zhenzhen, Q., Jinhua, T., Noorhassim, I., et al., 2016. Reference Ranges of Handgrip Strength From 125,462 Healthy Adults in 21 Countries: A Prospective Urban Rural Epidemiologic (PURE) Study. J Cachexia Sarcopenia Muscle,7, pp.535-546. doi: 10.1002/jcsm.12112.

Mainous, A.G., Tanner, R.J., Anton, S.D., & Jo, A., 2015. Grip Strength as A Marker of Hypertension and Diabetes in Healthy Weight Adults. Am J Prev Med, 49(6): pp.850-858. doi: 10.1016/j.amepre.2015.05.025.

Manoharan, V.S., Sundaram, S.G., & Jason, J.I., 2015. Factors Affecting Hand Grip Strength and Its Evaluation: A Systemic Review. Int J Physiother Res, 3(6): pp.1288-1293. doi:10.16965/ijpr.2015.193.

McGrath, R., Johnson, N., Klawitter, L., Mahoney, S., Trautman, K., Carlson, C., Rockstad, E., & Hackney, K.J., 2020. What Are The Association Patterns Between Handgrip Strength and Adverse Health Conditions? A Topical Review. SAGE Open Medicine, 8, pp.1-12. doi:10.1177/2050312120910358.

Nakanishi, S., Shimoda, M., Kimura, T., Sanada, J., Fushimi, Y., Iwamoto, Y., Iwamoto, H., Dan, K., Mune, T., Kaku, K., et al., 2024. The Impact of Handgrip Strength and Waist Circumference on Glycemic Control: Prospective, Observational Study Using Outpatient Clinical Data in Japanese Patients With Type 2 Diabetes Mellitus. J Diabetes Investig, 15(7): pp.892-898. doi: 10.1111/jdi.14200.

Nathania, N.P.S., Nugraha, M.H.S., Primayanti, I.D.A., & Saraswati, P.A.S., 2023. Handgrip Strength is Associated With Balance in Elderly Women. Majalah Ilmiah Fisioterapi Indonesia, 11, pp.70-75.

Peraturan Gubernur Provinsi Daerah Khusus Ibukota Jakarta Nomor 7 tahun 2017 Tentang Penanganan Prasarana dan Sarana Umum Tingkat Kelurahan. Jakarta 2017.

Richter, E.A., & Hargreaves, M., 2013. Exercise, GLUT4, and Skeletal Muscle Glucose Uptake. Physiol Rev, 93(3): pp.993-1017. doi: 10.1152/physrev.00038.2012.

Rokhmah, F.D., Handayani, D., & Al-Rasyid, H., 2015. Korelasi Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul Terhadap Kadar Glukosa Plasma Menggunakan Tes Toleransi Glukosa Oral. Jurnal Gizi Klinik Indonesia,12, pp.28-35.

Rondhianto., Ridla, A.Z., & Hasan, H., 2024. Sociodemographic Factors Affecting Diabetic Dietary Behavior in People with Type 2 Diabetes Mellitus. KEMAS, 19(3):pp.429-437. doi: 10.15294/kemas.v19i3.37856

Safitri, I., Setyarsih, L., Susanto, H., Suhartono., & Fitranti, D.Y., 2020. The Effect of Low and High Glycemic Load Diet on Muscle Fatigue of Young Soccer. KEMAS, 16(1):pp.111-120. doi: 10.15294/kemas.v16i1.23508

Schrager, M.A., Metter, E.J., Simonsick, E., Ble, A., Bandinelli, S., Lauretani, F., & Ferrucci, L., 2007. Sarcopenic Obesity and Inflammation in The Inchianti Study. J Appl Physiol, 102(3): pp.919-925. doi: 10.1152/japplphysiol.00627.2006.

Sirajudeen, M.S., Shah, U.N., Pillai, P.S., Mohasin, N., & Shantaram, M., 2012. Correlation Between Grip Strength and Physical Factors in Men. International Journal of Health and Rehabilitation Sciences, 1, pp.58-63.

Soenyoto, T., Mollap, K., & Mungpong, J., 2017. Correlation of Energy and Protein Consumption Levels with Physical Endurance of Rhythmic Gymnast Athletes. KEMAS, 13(1):pp.131-136. doi: 10.15294/kemas.v13i1.9888

Soraya, N., & Parwanto, E., 2023. The Controversial Relationship Between Body Mass Index and Handgrip Strength in The Elderly: An Overview. Malays J Med Sci, 30, pp.73-83.

Vaishya, R., Misra, A., Vaish, A., Ursino, N., & D'Ambrosi, R., 2024. Hand Grip Strength as A Proposed New Vital Sign Of Health: A Narrative Review of Evidences. Journal of Health, Population and Nutrition, 43, pp.1-14. doi:10.1186/s41043-024-00500-y.

Widjaja, D., Tjhai, K., Dermawan, K., Kalim, J., Tanzil, S., Pramusinta, A., Phenca, H.K., Kurniawan, A., 2018. Correlations Between Hand Grip Strength and Anthropometric Status in Young Indonesian Adults. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.

Zaccagni, L., Toselli, S., Bramanti, B., Gualdi-Russo, E., Mongillo, J., & Rinaldo, N., 2020. Handgrip Strength in Young Adults: Association With Anthropometric Variables and Laterality. Int J Environ Res Public Health, 17, pp.1-18. doi:10.3390/ijerph17124273.

4. Bukti konfirmasi review dan hasil review kedua (21 Juli 2025)

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Factors Associated With Handgrip Strength of Public Works Personnel in West Jakarta

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Abstract

Public Works Personnel (PWP) in Jakarta perform their routine duties manually instead of using equipment. Handgrip strength (HGS) measures maximum hand strength as a quality indicator for muscle strength and mass. Factors affecting muscle strength are age, sex, body mass index (BMI), waist circumference (WC), and hip circumference (HC). Increased fasting blood glucose (FBG) is also associated with muscle quality, muscle strength, and physical performance. This study aimed to determine the factors associated with handgrip strength in PWP. A total of 192 male PWP from the Cengkareng district were recruited by simple random sampling. Collected data were demographics, BMI, FBG, WC, HC, and HGS. Statistical analysis was done using Pearson's correlation test and multiple regression analysis. There was a significant positive correlation of BMI, WC, and HC with HGS ($p=0.006$; $r=0.20$, $p=0.009$; $r=0.19$ and $p=0.005$; $r=0.20$) and a significant negative correlation between age and HGS ($p=0.008$; $r=-0.19$) but not between FBG and HGS ($p=0.847$). Multiple regression analysis showed height, BMI, and HC positively predicting HGS ($R^2=0.19$). Handgrip strength of public works personnel is associated with BMI, age, waist circumference, and hip circumference, but not with fasting blood glucose. Height, BMI, and hip circumference predict handgrip strength.

Keywords: Handgrip strength, Body mass index, Hip circumference, Waist circumference, Fasting blood glucose

INTRODUCTION

Personnel for the management of public infrastructure and facilities at the village level are workers who manage village public works for a given time period on the basis of a work order. The tasks of village-level public works personnel (PWP) consist of managing the infrastructure and facilities, such as streets, drains, and parks, including installed lights (Peraturan Gubernur DKI Jakarta, 2017). The work performed by village PWP consists mainly of intense physical activity involving the hands, such that handgrip strength is essential in their tasks. Lowering of handgrip strength may indicate reduced muscle strength, which may especially interfere with the daily activities of village PWP that consist mainly of manual labor.

Handgrip strength measures maximal hand strength and indicates muscle quality that reflects muscle strength and mass. Muscle strength refers to the ability of muscle groups to raise a given load. Low or poor grip strength is frequently associated with damaging health impacts, such as chronic disease, and is the initial sign of reduced muscle mass, limitations in physical functions, and mortality risk. Poor handgrip strength may also reduce a person's ability to perform activities of daily living and, therefore, impact quality of life (Soraya et al., 2023; Nathania et al., 2023). Muscle mass accounts for approximately 40% of total weight, such that knowledge of muscle mass conditions is essential in maintaining health and activities (Handayani et al,. 2018).

Handgrip strength may represent the strength of all muscles in the body. Several factors possibly influencing an individual's muscle strength are age, sex, and body mass index (BMI) (Soraya et al., 2023). Obesity may also affect BMI. Obesity in adults is not only associated with genetic factors but also with environmental factors during development (Fauzi et al., 2022). Handgrip strength is also associated with chronic diseases such as diabetes, metabolic syndrome, and cardiovascular disease. Increased glucose concentration is also associated with disorders of muscle quality and strength, as well as physical performance (Chen et al., 2023). A reduction in muscle mass also affects an individual's strength and physical endurance. A combination of proteins is considered to be able to maintain muscle function, thereby building body strength and physical endurance (Soenyoto et al., 2017). In the present study, we included fasting blood glucose concentrations in the data collection in order to obtain more accurate measures of glucose concentrations that have not yet been influenced by food intake.

Handgrip strength may be a health indicator that provides information on a person's health (Vaishya et al., 2024). However, its clinical significance in determining the prevention and treatment of poor handgrip remains limited because of the still unclear etiology of muscle weakness, especially because the clinical outcomes associated with handgrip strength are extremely diverse (Mc Grath et al., 2020). The relationship between BMI and handgrip strength is still controversial, with several investigators finding a significant positive association and others reporting a non-significant relationship (Al Asadi, 2018).

There are few studies on handgrip strength, especially on workers in the sanitation sector such as public works personnel, such that the present investigators were interested in studying this topic. The aim of the present study was to determine the factors associated with handgrip strength in public works personnel.

METHOD

This cross-sectional study involving male public works personnel in Cengkareng District, West Jakarta, was conducted from September to October 2024. The study sample was selected by simple random sampling. Calculation of the sample size for a correlation with r=0.2, Zα=0.05, and Zβ=0.1, resulted in a sample of 192 subjects who met the inclusion criterion of being male and 25-60 years old, and the exclusion criteria of having an abnormality of the hands, heart disease, pulmonary disease, and malignancies.

Measurements were obtained on height in cm, weight in kg, as well as waist circumference and hip circumference in cm. Height and weight were determined using microtoise and digital scales, respectively. BMI was calculated using the formula of weight divided by height squared. Measurement of waist and hip circumferences was done using measuring tape. Waist circumference was determined with the subject in the upright position, at the end of a normal expiration, at the smallest abdominal circumference between the iliac crest and twelfth rib. The cut-off values for waist circumference in males and females are ≥ 90 cm and ≥ 80 cm, respectively. Hip circumference was measured using measuring tape that was applied around the hips at the level of the symphysis pubis and the maximal gluteal circumference (Rokhmah et al., 2015; Ilmi et al., 2020).

Fasting blood glucose (FBG) concentration was determined on venous blood by the hexokinase method after the respondents had fasted approximately 10 hours prior. Handgrip strength was measured with a handgrip strength dynamometer to the nearest kilogram as follows: The respondent was asked to sit down comfortably without reclining and with the feet completely relaxed. The hips and knees were positioned at a 90^0 angle, the gripping hand with the shoulder in adduction, the elbow flexed 90^0, and the forearm and wrist in the neutral position. The gripping duration was 3 seconds. The respondent gripped the instrument with the dominant hand as hard as possible and the value indicated by the needle was recorded. In accordance with the protocol recommended by the American Society of Hand Therapists (ASHT), the recorded handgrip strength was the average of three handgrip strength tests (Nathania et al., 2023).

Prior to data analysis by means of the correlation test, the normality of the data distribution was determined using the Kolmogorov-Smirnov test. The Pearson correlation test was used for a normal data distribution, whereas for a non-normal data distribution, the Spearman correlation test was done, followed by a multiple regression analysis.

Ethics approval was issued by the Ethics Committee of the Faculty of Medicine, Universitas Trisakti, under No. 033/KER/FK/08/2024.

RESULT AND DISCUSSION

In this study the respondents comprised 192 male public works personnel of Cengkareng District that consisted of the villages (subdistricts) of Kedaung, Duri Kosambi, West Cengkareng, Kapuk, and Rawa Buaya. A total of 26% of the respondents were residents of Duri Kosambi, where Muslims comprised 98.4% of the population. The majority of the respondents at 77.6% had an educational level of senior high school, nearly all of the respondents, or 99%, were right-handed, using the right hand as the dominant one at work, and most were of the Betawi (Jakarta) ethnic group at 51.6% (Table 1).

Table 1. Demographic data of the respondents

Characteristic	N (%)
Village	
Kedaung	40 (20.8)
Duri Kosambi	50 (26)
Cengkareng Barat	33 (17.2)
Kapuk	43 (22.4)
Rawa Buaya	26 (13.5)
Religion	
Islamic	189 (98.4)
Christian	2 (1)
Catholic	1 (0.5)
Level of education	
Elementary school	7 (3.6)
Junior high school	29 (15.1)
Senior high school	149 (77.6)
Academy-University	7 (3.6)
Dominant hand	
Right hand	190 (99)
Left hand	2 (1)
Ethnic group	
Javanese	53 (27.6)
Betawi	99 (51.6)
Sundanese	25 (13)
Other	14 (7.3)

Legend: Other ethnicities comprised groups from Palembang, Lampung, Bima, and Kupang

Source: primary data 2024 (questionnaires and interviews with respondents)

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Table 2. Respondents' characteristics

Variable	Mean ± SD
Age (years)	40.9 ± 8.9
Height (cm)	164.6 ± 6.7
Weight (kg)	64.7 ± 13.1
BMI (kg/m^2)	23.8 ± 4.3
Waist circumference (cm)	85.4 ± 10.4
Hip circumference (cm)	96.9 ± 8.4
HGS (kg)	33.1 ± 6.9
FBG (mg/dL)	87 (64-280)*

Legend: BMI: body mass index. *FBG: fasting blood glucose, expressed as Median (Min-Max).
HGS: handgrip strength
Source: primary data (respondents' measurements)

The bivariate analysis found a significant positive correlation of BMI, height, weight, waist circumference, and hip circumference with handgrip strength (p=0.006, r=0.20; p=<0.001, r=0.36; p=<0.001, r=0.32; p=0.009, r=0.19; p= 0.005; r=0.20, respectively). This showed that the larger the BMI, height, weight, waist circumference, and hip circumference, the stronger the handgrip. However, there was no significant relationship between fasting glucose concentration and handgrip strength (p=0.847). This study also found that age had a significant negative correlation with handgrip strength (p=0.011; r= -0.182), signifying that the older a person, the lower the handgrip strength (Table 3). Results of multiple regression analysis on handgrip strength are listed in Table 4.

Table 3. Analysis of the relationship of age, height, weight, BMI, waist circumference, hip circumference, and fasting blood glucose concentration with handgrip strength

Variable	R	P value
Age	- 0.19	0.008*
Height	0.36	0.000*
Weight	0.32	0.000*
BMI	0.20	0.006*
Waist circumference	0.19	0.009*
Hip circumference	0.20	0.005*
FBG	0.02	0.847#

*P value with Pearson's test, # Spearman's test
Source: primary data

Table 4. Multiple regression analysis on handgrip strength

Determinant	b	SE	p
Height	0.48	0.08	0.000
BMI	0.79	0.22	0.000
Hip circumference	- 0.29	0.12	0.015
Constant	- 36.98		

R^2=0,19

Source: primary data

This study found that most of the public works personnel in Duri Kosambi village were Muslims, had a senior high school level of education, and were of Betawi ethnicity. This was in line with the demographic data in Cengkareng district, in that Duri Kosambi was the village with the greatest area, the majority of the residents were male, and the Islamic religion had the most believers (Badan Pusat Statistik Jakarta Barat, 2020). Among our respondents, more than ten percent were in the diabetes category. Socio-demographic factors capable of affecting dietary habits in patients with diabetes are level of education and type of family (Rondhianto et al., 2024). Among the respondents of this study, the dominant right hand was used for working. In the adult population, a total of 90% of the residents preferred to use the right hand for manual tasks, whereas around 10% used the left hand (Zaccagni et al., 2020). According to Agtuahene et al. (Agtuahene et al., 2023), the dominant hand is generally around 10% stronger than the non-dominant hand. Many activities in daily life need a high level of exertion of the muscles of the hand and forearm (Hammed et al., 2017). The frequent use of the dominant hand in daily living results in the muscles of the hand and forearm providing strength in gripping (Afaq et al., 2019).

The mean handgrip strength in this study was 33.1 ± 6.9 kg, which is relatively low if compared with the study results of Kurniawan et al. (Kurniawan et al., 2018). in healthy young Indonesian adults, where mean handgrip strength in males was 37.37 ± 8.29 kg and the lower limit of muscle strength in Indonesian males was 20.79 kg. The handgrip strength results in both studies are still below those of males in other Southeast Asian countries, according to the study results of Leong et al. (Leong et al., 2016). These investigators found that the mean handgrip strength in Southeast Asian males aged 35-40 years was 40 kg (34-44 kg); for the age range of 41-50 years, the handgrip strength was 38 kg (33-44 kg), for the age range of 51-60 years it was 34 kg (30-40 kg), and for ages 61-70 years 30 kg (24-34 kg). This may have been caused by ethnic differences mediated by genetic differences that also affect individual muscle strength. The highest handgrip strength is found in the European and North American populations, whereas the lowest handgrip strength is found in African, South Asian, and Southeast Asian populations. These variations in muscle strength in various countries may also be partly caused by differences in socio-economic status (Leong et al., 2016).

According to Agtuahene et al. (Agtuahene et al., 2023), handgrip strength is a physiological variable influenced by several factors, such as age, sex, and body measurements. In contrast, according to Zaccagni et al. (Zaccagni et al., 2020), handgrip strength, apart from being affected by age, may also be influenced by physical activity, grip measurement, height, and body mass. The present study found a significant positive correlation between BMI and handgrip strength. According to Hammed et al., this may be caused by the higher percentage of skeletal muscle mass compared to the percentage of fat mass, thereby resulting in a higher handgrip strength [13]. Our study's results are identical to those of Agtuahene et al. (Agtuahene et al., 2023), who found a

significant positive correlation (r= 0.290) of handgrip strength with BMI and height. This shows that taller individuals with higher BMI apparently have greater handgrip strength. Our study is also in line with the study of Krakauer in 2020, which showed a positive correlation between BMI and handgrip strength (Krakauer et al., 2020).

The study of Cooper et al. (Cooper et al., 2022) concluded that a high childhood BMI is associated with higher grip strength at age 46 years. This is because fat mass acts as a mechanical load that elicits an anabolic response that stimulates muscle growth and function. This anabolic response is usually greater in males than in females because of the higher testosterone concentration in males. However, it should also be noted that BMI does not differentiate between fat mass and lean mass as adipocyte indicators that may vary with sex. It should be noted that BMI is a measure of body fat that does not differentiate between weight changes as a result of an increase or decrease in muscle mass or body fat (Zaccagni et al., 2020). According to Jafar et al. (Jaafar et al., 2023), heavier individuals have a greater muscle mass, resulting in greater handgrip strength, than lighter individuals. In the study of Heidy et al. (Heidy et al., 2019), the investigators found a positive correlation between height and forearm length. The study by Sirajudeen et al. (Sirajudeen et al., 2012) found a positive correlation between hand length and handgrip strength. This shows that height affects the longer extremity or arm, thus approaching optimal muscle length that may result in greater grip strength. According to a prospective cohort study, handgrip strength in middle age appears to be associated with birth weight and the increase in height at puberty. Pubertal growth and handgrip strength possibly represent the development of muscle size and growth (Schrager et al., 2007).

Our study found no relationship between blood glucose concentration and handgrip strength. Our study agrees with the study of Giglio et al. (Giglio et al., 2018), which showed no significant relationship between muscle mass strength and blood glucose concentration. According to Giglio, this is because most respondents are individuals who routinely perform structured physical activity, even though they are in the light category. This is similar to our study respondents, who were public works personnel and who had performed physical activity such as street sweeping and cleaning storm drains. Glucose is the main fuel for muscle contraction, entering the muscle cells by diffusion through the GLUT4 glucose transporter, which, after muscle contraction, moves from its intracellular storage site to the plasma membrane and T-tubules (Richter et al., 2013). Glucose metabolism has an influence on handgrip strength through various mechanisms, such as disorders of glucose metabolism, particularly glycogenolysis, that may result in the loss of muscle strength. Insulin resistance in hyperglycemia may cause muscle degradation because hyperglycemia causes low muscle strength through effects on skeletal muscle mitochondria. The lowering of muscle strength by hyperglycemia occurs through Krüppel-like factor 15, which regulates skeletal muscle lipid flux. Hyperglycemia also increases pro-inflammatory cytokines, which may increase the catabolism that plays a role in the further decrease in muscle mass and quality (Gamayanti et al., 2023). The amount of carbohydrates also influences the glycemic response and post-prandial insulin level, impacting the supply of glycogen to the muscles (Safitri et al.,2020).

This study has a significant negative correlation between age and handgrip strength, which decreases with age (Manoharan et al., 2015). Handgrip strength initially experiences an increase with increasing age, reaches its peak between the age of 30 and 40 years, and decreases afterward (Zaccagni et al., 2020). The age-related changes in skeletal muscle composition, particularly the accumulation of lipids in skeletal muscle fibers, play a role in the poor quality of the muscles and may result in metabolic abnormalities such as insulin resistance. Apart from changes in muscle

quality, there is also a reduction in muscle mass that is consistently occurring during aging. The increase in oxidative stress and chronic inflammation that commonly occurs in the aging process apparently also plays a role in the development of decreased muscle mass and strength (Mainous et al., 2015). The decrease in muscle mass in the elderly corresponds to a 10% reduction in grip strength per decade, starting from the age of 40 years (Jaafar et al., 2023). Skeletal muscle plays an important role in glucose metabolism and has a significant influence on insulin sensitivity. Increased insulin resistance in older adults may be closely associated with skeletal muscle aging. A reduction in GLUT4 expression as a result of a decrease in muscle volume causes a reduction in insulin sensitivity in aging skeletal muscle (Joo et al., 2022).

The results of this study showed a correlation of waist circumference and hip circumference with handgrip strength. This is in line with the study of Widjaja et al. (Widjaja et al., 2018), who stated that there was a significant correlation of waist circumference and hip circumference with handgrip strength ($p=<0.001$, $r=0.302$; and $p=<0.001$, $r=0.296$) A greater waist circumference is associated with a greater handgrip strength in males (Hardy et al., 2013).

In the multiple regression analysis of HGS, we removed the data on body weight because of the occurrence of multicollinearity between weight and BMI, with a correlation coefficient of more than 0.9, indicating an extremely strong relationship between these two variables. Conceptually, only one of the variables is used in multivariate analysis. The multiple regression analysis included age, height, BMI, waist circumference, and hip circumference, with HGS as dependent variable in a stepwise dependent manner. After three iterations, only height, BMI, and hip circumference played a role in predicting HGS by means of the regression formula, which resulted in $R^2=0.19$. This signifies that for known values of height, BMI, and hip circumference, we can predict the HGS value 19% more accurately than without a knowledge of these data. For a clinical diagnosis, a minimum increase of 10% is needed. This study found that height, BMI, and hip circumference play a role in predicting handgrip strength through the regression formula, i.e., handgrip strength = - 36.98 + 0.48 x height + 0.79 x BMI – 0.29 x hip circumference. Handgrip strength and waist circumference are surrogate muscle strength and visceral adiposity markers, respectively (Nakanishi et al., 2024). Waist circumference is also more sensitive in determining body fat distribution, particularly in the abdomen. Waist circumference correlates better with abdominal fat distribution than BMI (Rokhmah et al., 2015). Waist circumference and hip circumference are associated with obesity, in which the fat content is higher, and the skeletal muscle and fascicular content is lower, thereby resulting in a lower contractile capacity of skeletal muscle (Afaq et al., 2019).

The limitation of this study is that it did not evaluate other factors that may affect handgrip strength, such as nutrient intake. From the anthropometric measures of the hands and feet in this study, the causes and effects of the decrease in handgrip strength could not be determined because this study used a cross-sectional design.

CONCLUSION

There are three factors that may be used to estimate handgrip strength in PWP, namely height, BMI, and hip circumference, whereas blood glucose concentration is not correlated with handgrip strength in PWP. It is recommended to pay attention to height, BMI, and hip circumference,

particularly in the acceptance criteria of PWP candidates, and to conduct further studies with consideration of other factors that affect handgrip strength, such as food intake and anthropometric features of the hands and arms.

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REFERENCES

Afaq, E., Hassan, S.H., Khan, M.R., Zaidi, D.A., & Baktashi, H., 2019. Correlation of Hand Dynamometry With Body Mass Index and Waist Hip Ratio in Medical Students. Pak J Physiol,15, pp.19-21.

Agtuahene, M.A., Quartey, J., & Kwakye, S., 2023. Influence of Hand Dominance, Gender, and Body Mass Index on Hand Grip Strength. S Afr J Physiother, 79, pp.1-6. doi: org/10.4102/sajp.v79i1.1923.

Al-Asadi, J.N., 2018. Handgrip Strength in Medical Students: Correlation with Body Mass Index and Hand Dimensions. Asian Journal of Medical Sciences, 9, pp.21-26. doi: 10.3126/ajms.v9i1.18577.

Badan Pusat Statistik Kota Administrasi Jakarta Barat., 2020. Kecamatan Cengkareng Dalam Angka, pp. 1-114.

Chen, D., Zhu, Y., Ni, W., Li, Y., Yin, G., Shao, Z., & Zhu, J., 2023. Hand Grip Strength is Inversely Associated with Total Daily Insulin Dose Requirement in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study. PeerJ, pp.1-13. doi: 10.7717/peerj.15761.

Cooper, R., Tomlinson, D., Hamer, M., & Pereira, S.M.P., 2022. Lifetime Body Mass Index and Grip Strength at Age 46 Years: The 1970 British Cohort Study. J Cachexia Sarcopenia Muscle, 13, pp.1-10. doi: 10.1002/jcsm.12992.

Fauzi, L., Handayani, O.W.K., Susilo, M.T., Kurnia, A.R., Rahayu, S.R., Irawan, F.A., Horng Lu, F.J., Lin, C., Lai, M.F., & Yu, Y.C., 2022. Obesity in Indonesian and Taiwanese Adolescents Related to Self Perception, Diet, Exercise and Body Image. KEMAS, 17(3):pp.453-461. doi: 10.15294/kemas.v17i3.34396

Gamayanti, K.A.V., Aryana, I.G.P.S., & Gotera, W., 2023. Hubungan Antara Kekuatan Genggaman Tangan Dengan Kadar Gula Darah Sewaktu Pada Lansia Di Desa Melinggih, Kecamatan Payangan, Kabupaten Gianyar. Intisari Sains Medis, 14(2): pp.483-488.

Giglio, B.M., Mota, J.F., Wall, B.T., & Pimentel, G.D., 2018. Low Handgrip Strength is Not Associated With Type 2 Diabetes Mellitus and Hyperglycemia: A Population-Based Study. Clin Nutr Res, 7(2): pp.112-116. doi: 10.7762/cnr.2018.7.2.112.

Hammed, A.I., & Obaseki, C.O., 2017. Interdependence of Body Mass Index with Handgrip Strength and Endurance Among Apparently Healthy Teenagers. Turk J Kin, 4, pp.1-7.

Handayani, M.D.N., Sadewa, A.H., Farmawati, A., & Rochmah, W., 2018. Anthropometric Prediction Equations for Estimating Muscle Mass of Elderly Women. KEMAS, 14(2):pp.195-204. doi: 10.15294/kemas.v14i2.14073

Hardy, R., Cooper, R., Sayer, A.A., Shlomo, Y.B., Cooper, C., Deary, I.J., Demakakos, P., Gallacher, J., Martin, R.M., McNeill, G., et al., 2013. Body Mass Index, Muscle Strength and Physical Performance in Older Adults From Eight Cohort Studies: The Halcyon Programme. PLoS One, 8(2): pp.e56483. doi: 10.1371/journal.pone.0056483.

Heidy., Djuartina, T., & Irawan, R., 2019. Korelasi Kekuatan Genggaman Tangan Dengan Karakter Antropometri Lengan Bawah dan Tangan Serta Indeks Massa Tubuh. Damianus Journal of Medicine,18, pp.1-7.

Ilmi, A.F., & Utari, D.M., 2020. Hubungan Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul (RLPP) Terhadap Kadar Glukosa Darah Puasa Pada Mahasiswa. Journal of Nutrition College, 9, pp.222-227.

Jaafar, M.H., Ismail, R., Ismail, N.H., Isa, Z.M., Tamil, A.M., Nasir, N.M., Keat, N.K., Razak, N.H., Abidin, N.Z., & Yusof, K.H., 2023. Normative Reference Values and Predicting Factors of Handgrip Strength For Dominant and Non-Dominant Hands Among Healthy Malay Adults in Malaysia. BMC Musculoskelet Disord, 24, pp. 1-9. doi: 10.1186/s12891-023-06181-8.

Joo, K.C., Son, D.H., & Park, J.M., 2022. Association Between Relative Handgrip Strength and Insulin Resistance in Korean Elderly Men Without Diabetes: Findings Of The 2015 Korea National Health Nutrition Examination Survey. Korean J Fam Med, 43, pp.199-205. doi:10.4082/kjfm.21.0138.

Krakauer, N.Y., & Krakauer, J.C., 2020. Association of Body Shape Index (ABSI) with Hand Grip Strength. Int J Environ Res Public Health,17, pp.1-12. doi: doi:10.3390/ijerph17186797.

Kurniawan, A., Widjaja, D., & Lugito, N.P.H., 2018. Mean and Cutoff Value of Hand Grip Strength For Healthy Indonesian Young Adults. World Congress on Osteoporosis, Osteoartritis and Musculoskeletal Diseases; Krakow, Poland.

Leong, D.P., Teo, K.K., Rangarajan, S., Kutty, R., Lanas, F., Hui, C., Quanyong, X., Zhenzhen, Q., Jinhua, T., Noorhassim, I., et al., 2016. Reference Ranges of Handgrip Strength From 125,462 Healthy Adults in 21 Countries: A Prospective Urban Rural Epidemiologic (PURE) Study. J Cachexia Sarcopenia Muscle,7, pp.535-546. doi: 10.1002/jcsm.12112.

Mainous, A.G., Tanner, R.J., Anton, S.D., & Jo, A., 2015. Grip Strength as A Marker of Hypertension and Diabetes in Healthy Weight Adults. Am J Prev Med, 49(6): pp.850-858. doi: 10.1016/j.amepre.2015.05.025.

Manoharan, V.S., Sundaram, S.G., & Jason, J.I., 2015. Factors Affecting Hand Grip Strength and Its Evaluation: A Systemic Review. Int J Physiother Res, 3(6): pp.1288-1293. doi:10.16965/ijpr.2015.193.

McGrath, R., Johnson, N., Klawitter, L., Mahoney, S., Trautman, K., Carlson, C., Rockstad, E., & Hackney, K.J., 2020. What Are The Association Patterns Between Handgrip Strength and Adverse Health Conditions? A Topical Review. SAGE Open Medicine, 8, pp.1-12. doi:10.1177/2050312120910358.

Nakanishi, S., Shimoda, M., Kimura, T., Sanada, J., Fushimi, Y., Iwamoto, Y., Iwamoto, H., Dan, K., Mune, T., Kaku, K., et al., 2024. The Impact of Handgrip Strength and Waist Circumference on Glycemic Control: Prospective, Observational Study Using Outpatient Clinical Data in Japanese Patients With Type 2 Diabetes Mellitus. J Diabetes Investig, 15(7): pp.892-898. doi: 10.1111/jdi.14200.

Nathania, N.P.S., Nugraha, M.H.S., Primayanti, I.D.A., & Saraswati, P.A.S., 2023. Handgrip Strength is Associated With Balance in Elderly Women. Majalah Ilmiah Fisioterapi Indonesia, 11, pp.70-75.

Peraturan Gubernur Provinsi Daerah Khusus Ibukota Jakarta Nomor 7 tahun 2017 Tentang Penanganan Prasarana dan Sarana Umum Tingkat Kelurahan. Jakarta 2017.

Richter, E.A., & Hargreaves, M., 2013. Exercise, GLUT4, and Skeletal Muscle Glucose Uptake. Physiol Rev, 93(3): pp.993-1017. doi: 10.1152/physrev.00038.2012.

Rokhmah, F.D., Handayani, D., & Al-Rasyid, H., 2015. Korelasi Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul Terhadap Kadar Glukosa Plasma Menggunakan Tes Toleransi Glukosa Oral. Jurnal Gizi Klinik Indonesia,12, pp.28-35.

Rondhianto., Ridla, A.Z., & Hasan, H., 2024. Sociodemographic Factors Affecting Diabetic Dietary Behavior in People with Type 2 Diabetes Mellitus. KEMAS, 19(3):pp.429-437. doi: 10.15294/kemas.v19i3.37856

Safitri, I., Setyarsih, L., Susanto, H., Suhartono., & Fitranti, D.Y., 2020. The Effect of Low and High Glycemic Load Diet on Muscle Fatigue of Young Soccer. KEMAS, 16(1):pp.111-120. doi: 10.15294/kemas.v16i1.23508

Schrager, M.A., Metter, E.J., Simonsick, E., Ble, A., Bandinelli, S., Lauretani, F., & Ferrucci, L., 2007. Sarcopenic Obesity and Inflammation in The Inchianti Study. J Appl Physiol, 102(3): pp.919-925. doi: 10.1152/japplphysiol.00627.2006.

Sirajudeen, M.S., Shah, U.N., Pillai, P.S., Mohasin, N., & Shantaram, M., 2012. Correlation Between Grip Strength and Physical Factors in Men. International Journal of Health and Rehabilitation Sciences, 1, pp.58-63.

Soenyoto, T., Mollap, K., & Mungpong, J., 2017. Correlation of Energy and Protein Consumption Levels with Physical Endurance of Rhythmic Gymnast Athletes. KEMAS, 13(1):pp.131-136. doi: 10.15294/kemas.v13i1.9888

Soraya, N., & Parwanto, E., 2023. The Controversial Relationship Between Body Mass Index and Handgrip Strength in The Elderly: An Overview. Malays J Med Sci, 30, pp.73-83.

Vaishya, R., Misra, A., Vaish, A., Ursino, N., & D'Ambrosi, R., 2024. Hand Grip Strength as A Proposed New Vital Sign Of Health: A Narrative Review of Evidences. Journal of Health, Population and Nutrition, 43, pp.1-14. doi:10.1186/s41043-024-00500-y.

Widjaja, D., Tjhai, K., Dermawan, K., Kalim, J., Tanzil, S., Pramusinta, A., Phenca, H.K., Kurniawan, A., 2018. Correlations Between Hand Grip Strength and Anthropometric Status in Young Indonesian Adults. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.

Zaccagni, L., Toselli, S., Bramanti, B., Gualdi-Russo, E., Mongillo, J., & Rinaldo, N., 2020. Handgrip Strength in Young Adults: Association With Anthropometric Variables and Laterality. Int J Environ Res Public Health, 17, pp.1-18. doi:10.3390/ijerph17124273.

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Factors Associated With Handgrip Strength of Public Works Personnel in West Jakarta

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Abstract

Public Works Personnel (PWP) in Jakarta perform their routine duties manually instead of using equipment. Handgrip strength (HGS) measures maximum hand strength as a quality indicator for muscle strength and mass. Factors affecting muscle strength are age, sex, body mass index (BMI), waist circumference (WC), and hip circumference (HC). Increased fasting blood glucose (FBG) is also associated with muscle quality, muscle strength, and physical performance. This study aimed to determine the factors associated with handgrip strength in PWP. A total of 192 male PWP from the Cengkareng district were recruited by simple random sampling. Collected data were demographics, BMI, FBG, WC, HC, and HGS. Statistical analysis was done using Pearson's correlation test and multiple regression analysis. There was a significant positive correlation of BMI, WC, and HC with HGS ($p=0.006$; $r=0.20$, $p=0.009$; $r=0.19$ and $p=0.005$; $r=0.20$) and a significant negative correlation between age and HGS ($p=0.008$; $r=-0.19$) but not between FBG and HGS ($p=0.847$). Multiple regression analysis showed height, BMI, and HC positively predicting HGS ($R^2=0.19$). Handgrip strength of public works personnel is associated with BMI, age, waist circumference, and hip circumference, but not with fasting blood glucose. Height, BMI, and hip circumference predict handgrip strength.

Keywords: Handgrip strength, Body mass index, Hip circumference, Waist circumference, Fasting blood glucose

INTRODUCTION

Personnel for the management of public infrastructure and facilities at the village level are workers who manage village public works for a given time period on the basis of a work order. The tasks of village-level public works personnel (PWP) consist of managing the infrastructure and facilities, such as streets, drains, and parks, including installed lights (Peraturan Gubernur DKI Jakarta, 2017). The work performed by village PWP consists mainly of intense physical activity involving the hands, such that handgrip strength is essential in their tasks. Lowering of handgrip strength may indicate reduced muscle strength, which may especially interfere with the daily activities of village PWP that consist mainly of manual labor.

Handgrip strength measures maximal hand strength and indicates muscle quality that reflects muscle strength and mass. Muscle strength refers to the ability of muscle groups to raise a given load. Low or poor grip strength is frequently associated with damaging health impacts, such as chronic disease, and is the initial sign of reduced muscle mass, limitations in physical functions, and mortality risk. Poor handgrip strength may also reduce a person's ability to perform activities of daily living and, therefore, impact quality of life (Soraya et al., 2023; Nathania et al., 2023). Muscle mass accounts for approximately 40% of total weight, such that knowledge of muscle mass conditions is essential in maintaining health and activities (Handayani et al,. 2018).

Handgrip strength may represent the strength of all muscles in the body. Several factors possibly influencing an individual's muscle strength are age, sex, and body mass index (BMI) (Soraya et al., 2023). Obesity may also affect BMI. Obesity in adults is not only associated with genetic factors but also with environmental factors during development (Fauzi et al., 2022). Handgrip strength is also associated with chronic diseases such as diabetes, metabolic syndrome, and cardiovascular disease. Increased glucose concentration is also associated with disorders of muscle quality and strength, as well as physical performance (Chen et al., 2023). A reduction in muscle mass also affects an individual's strength and physical endurance. A combination of proteins is considered to be able to maintain muscle function, thereby building body strength and physical endurance (Soenyoto et al., 2017). In the present study, we included fasting blood glucose concentrations in the data collection in order to obtain more accurate measures of glucose concentrations that have not yet been influenced by food intake.

Handgrip strength may be a health indicator that provides information on a person's health (Vaishya et al., 2024). However, its clinical significance in determining the prevention and treatment of poor handgrip remains limited because of the still unclear etiology of muscle weakness, especially because the clinical outcomes associated with handgrip strength are extremely diverse (Mc Grath et al., 2020). The relationship between BMI and handgrip strength is still controversial, with several investigators finding a significant positive association and others reporting a non-significant relationship (Al Asadi, 2018).

There are few studies on handgrip strength, especially on workers in the sanitation sector such as public works personnel, such that the present investigators were interested in studying this topic. The aim of the present study was to determine the factors associated with handgrip strength in public works personnel.

METHOD

This cross-sectional study involving male public works personnel in Cengkareng District, West Jakarta, was conducted from September to October 2024. The study sample was selected by simple random sampling. Calculation of the sample size for a correlation with r=0.2, Zα=0.05, and Zβ=0.1, resulted in a sample of 192 subjects who met the inclusion criterion of being male and 25-60 years old, and the exclusion criteria of having an abnormality of the hands, heart disease, pulmonary disease, and malignancies.

Measurements were obtained on height in cm, weight in kg, as well as waist circumference and hip circumference in cm. Height and weight were determined using microtoise and digital scales, respectively. BMI was calculated using the formula of weight divided by height squared. Measurement of waist and hip circumferences was done using measuring tape. Waist circumference was determined with the subject in the upright position, at the end of a normal expiration, at the smallest abdominal circumference between the iliac crest and twelfth rib. The cut-off values for waist circumference in males and females are ≥ 90 cm and ≥ 80 cm, respectively. Hip circumference was measured using measuring tape that was applied around the hips at the level of the symphysis pubis and the maximal gluteal circumference (Rokhmah et al., 2015; Ilmi et al., 2020).

Fasting blood glucose (FBG) concentration was determined on venous blood by the hexokinase method after the respondents had fasted approximately 10 hours prior. Handgrip strength was measured with a handgrip strength dynamometer to the nearest kilogram as follows: The respondent was asked to sit down comfortably without reclining and with the feet completely relaxed. The hips and knees were positioned at a 90^0 angle, the gripping hand with the shoulder in adduction, the elbow flexed 90^0, and the forearm and wrist in the neutral position. The gripping duration was 3 seconds. The respondent gripped the instrument with the dominant hand as hard as possible and the value indicated by the needle was recorded. In accordance with the protocol recommended by the American Society of Hand Therapists (ASHT), the recorded handgrip strength was the average of three handgrip strength tests (Nathania et al., 2023).

Prior to data analysis by means of the correlation test, the normality of the data distribution was determined using the Kolmogorov-Smirnov test. The Pearson correlation test was used for a normal data distribution, whereas for a non-normal data distribution, the Spearman correlation test was done, followed by a multiple regression analysis.

Ethics approval was issued by the Ethics Committee of the Faculty of Medicine, Universitas Trisakti, under No. 033/KER/FK/08/2024.

RESULT AND DISCUSSION

In this study the respondents comprised 192 male public works personnel of Cengkareng District that consisted of the villages (subdistricts) of Kedaung, Duri Kosambi, West Cengkareng, Kapuk, and Rawa Buaya. A total of 26% of the respondents were residents of Duri Kosambi, where Muslims comprised 98.4% of the population. The majority of the respondents at 77.6% had an educational level of senior high school, nearly all of the respondents, or 99%, were right-handed, using the right hand as the dominant one at work, and most were of the Betawi (Jakarta) ethnic group at 51.6% (Table 1).

Table 1. Demographic data of the respondents

Characteristic	N (%)
Village	
Kedaung	40 (20.8)
Duri Kosambi	50 (26)
Cengkareng Barat	33 (17.2)
Kapuk	43 (22.4)
Rawa Buaya	26 (13.5)
Religion	
Islamic	189 (98.4)
Christian	2 (1)
Catholic	1 (0.5)
Level of education	
Elementary school	7 (3.6)
Junior high school	29 (15.1)
Senior high school	149 (77.6)
Academy-University	7 (3.6)
Dominant hand	
Right hand	190 (99)
Left hand	2 (1)
Ethnic group	
Javanese	53 (27.6)
Betawi	99 (51.6)
Sundanese	25 (13)
Other	14 (7.3)

Legend: Other ethnicities comprised groups from Palembang, Lampung, Bima, and Kupang

Source: primary data 2024 (questionnaires and interviews with respondents)

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Table 2. Respondents' characteristics

Variable	Mean ± SD
Age (years)	40.9 ± 8.9
Height (cm)	164.6 ± 6.7
Weight (kg)	64.7 ± 13.1
BMI (kg/m^2)	23.8 ± 4.3
Waist circumference (cm)	85.4 ± 10.4
Hip circumference (cm)	96.9 ± 8.4
HGS (kg)	33.1 ± 6.9
FBG (mg/dL)	87 (64-280)*

Legend: BMI: body mass index. *FBG: fasting blood glucose, expressed as Median (Min-Max).
HGS: handgrip strength
Source: primary data (respondents' measurements)

The bivariate analysis found a significant positive correlation of BMI, height, weight, waist circumference, and hip circumference with handgrip strength (p=0.006, r=0.20; p=<0.001, r=0.36; p=<0.001, r=0.32; p=0.009, r=0.19; p= 0.005; r=0.20, respectively). This showed that the larger the BMI, height, weight, waist circumference, and hip circumference, the stronger the handgrip. However, there was no significant relationship between fasting glucose concentration and handgrip strength (p=0.847). This study also found that age had a significant negative correlation with handgrip strength (p=0.011; r= -0.182), signifying that the older a person, the lower the handgrip strength (Table 3). Results of multiple regression analysis on handgrip strength are listed in Table 4.

Table 3. Analysis of the relationship of age, height, weight, BMI, waist circumference, hip circumference, and fasting blood glucose concentration with handgrip strength

Variable	R	P value
Age	- 0.19	0.008*
Height	0.36	0.000*
Weight	0.32	0.000*
BMI	0.20	0.006*
Waist circumference	0.19	0.009*
Hip circumference	0.20	0.005*
FBG	0.02	0.847#

*P value with Pearson's test, # Spearman's test
Source: primary data

Table 4. Multiple regression analysis on handgrip strength

Determinant	b	SE	p
Height	0.48	0.08	0.000
BMI	0.79	0.22	0.000
Hip circumference	- 0.29	0.12	0.015
Constant	- 36.98		

R^2=0,19

Source: primary data

This study found that most of the public works personnel in Duri Kosambi village were Muslims, had a senior high school level of education, and were of Betawi ethnicity. This was in line with the demographic data in Cengkareng district, in that Duri Kosambi was the village with the greatest area, the majority of the residents were male, and the Islamic religion had the most believers (Badan Pusat Statistik Jakarta Barat, 2020). Among our respondents, more than ten percent were in the diabetes category. Socio-demographic factors capable of affecting dietary habits in patients with diabetes are level of education and type of family (Rondhianto et al., 2024). Among the respondents of this study, the dominant right hand was used for working. In the adult population, a total of 90% of the residents preferred to use the right hand for manual tasks, whereas around 10% used the left hand (Zaccagni et al., 2020). According to Agtuahene et al. (Agtuahene et al., 2023), the dominant hand is generally around 10% stronger than the non-dominant hand. Many activities in daily life need a high level of exertion of the muscles of the hand and forearm (Hammed et al., 2017). The frequent use of the dominant hand in daily living results in the muscles of the hand and forearm providing strength in gripping (Afaq et al., 2019).

The mean handgrip strength in this study was 33.1 ± 6.9 kg, which is relatively low if compared with the study results of Kurniawan et al. (Kurniawan et al., 2018). in healthy young Indonesian adults, where mean handgrip strength in males was 37.37 ± 8.29 kg and the lower limit of muscle strength in Indonesian males was 20.79 kg. The handgrip strength results in both studies are still below those of males in other Southeast Asian countries, according to the study results of Leong et al. (Leong et al., 2016). These investigators found that the mean handgrip strength in Southeast Asian males aged 35-40 years was 40 kg (34-44 kg); for the age range of 41-50 years, the handgrip strength was 38 kg (33-44 kg), for the age range of 51-60 years it was 34 kg (30-40 kg), and for ages 61-70 years 30 kg (24-34 kg). This may have been caused by ethnic differences mediated by genetic differences that also affect individual muscle strength. The highest handgrip strength is found in the European and North American populations, whereas the lowest handgrip strength is found in African, South Asian, and Southeast Asian populations. These variations in muscle strength in various countries may also be partly caused by differences in socio-economic status (Leong et al., 2016).

According to Agtuahene et al. (Agtuahene et al., 2023), handgrip strength is a physiological variable influenced by several factors, such as age, sex, and body measurements. In contrast, according to Zaccagni et al. (Zaccagni et al., 2020), handgrip strength, apart from being affected by age, may also be influenced by physical activity, grip measurement, height, and body mass. The present study found a significant positive correlation between BMI and handgrip strength. According to Hammed et al., this may be caused by the higher percentage of skeletal muscle mass compared to the percentage of fat mass, thereby resulting in a higher handgrip strength [13]. Our study's results are identical to those of Agtuahene et al. (Agtuahene et al., 2023), who found a

significant positive correlation (r= 0.290) of handgrip strength with BMI and height. This shows that taller individuals with higher BMI apparently have greater handgrip strength. Our study is also in line with the study of Krakauer in 2020, which showed a positive correlation between BMI and handgrip strength (Krakauer et al., 2020).

The study of Cooper et al. (Cooper et al., 2022) concluded that a high childhood BMI is associated with higher grip strength at age 46 years. This is because fat mass acts as a mechanical load that elicits an anabolic response that stimulates muscle growth and function. This anabolic response is usually greater in males than in females because of the higher testosterone concentration in males. However, it should also be noted that BMI does not differentiate between fat mass and lean mass as adipocyte indicators that may vary with sex. It should be noted that BMI is a measure of body fat that does not differentiate between weight changes as a result of an increase or decrease in muscle mass or body fat (Zaccagni et al., 2020). According to Jafar et al. (Jaafar et al., 2023), heavier individuals have a greater muscle mass, resulting in greater handgrip strength, than lighter individuals. In the study of Heidy et al. (Heidy et al., 2019), the investigators found a positive correlation between height and forearm length. The study by Sirajudeen et al. (Sirajudeen et al., 2012) found a positive correlation between hand length and handgrip strength. This shows that height affects the longer extremity or arm, thus approaching optimal muscle length that may result in greater grip strength. According to a prospective cohort study, handgrip strength in middle age appears to be associated with birth weight and the increase in height at puberty. Pubertal growth and handgrip strength possibly represent the development of muscle size and growth (Schrager et al., 2007).

Our study found no relationship between blood glucose concentration and handgrip strength. Our study agrees with the study of Giglio et al. (Giglio et al., 2018), which showed no significant relationship between muscle mass strength and blood glucose concentration. According to Giglio, this is because most respondents are individuals who routinely perform structured physical activity, even though they are in the light category. This is similar to our study respondents, who were public works personnel and who had performed physical activity such as street sweeping and cleaning storm drains. Glucose is the main fuel for muscle contraction, entering the muscle cells by diffusion through the GLUT4 glucose transporter, which, after muscle contraction, moves from its intracellular storage site to the plasma membrane and T-tubules (Richter et al., 2013). Glucose metabolism has an influence on handgrip strength through various mechanisms, such as disorders of glucose metabolism, particularly glycogenolysis, that may result in the loss of muscle strength. Insulin resistance in hyperglycemia may cause muscle degradation because hyperglycemia causes low muscle strength through effects on skeletal muscle mitochondria. The lowering of muscle strength by hyperglycemia occurs through Krüppel-like factor 15, which regulates skeletal muscle lipid flux. Hyperglycemia also increases pro-inflammatory cytokines, which may increase the catabolism that plays a role in the further decrease in muscle mass and quality (Gamayanti et al., 2023). The amount of carbohydrates also influences the glycemic response and post-prandial insulin level, impacting the supply of glycogen to the muscles (Safitri et al.,2020).

This study has a significant negative correlation between age and handgrip strength, which decreases with age (Manoharan et al., 2015). Handgrip strength initially experiences an increase with increasing age, reaches its peak between the age of 30 and 40 years, and decreases afterward (Zaccagni et al., 2020). The age-related changes in skeletal muscle composition, particularly the accumulation of lipids in skeletal muscle fibers, play a role in the poor quality of the muscles and may result in metabolic abnormalities such as insulin resistance. Apart from changes in muscle

quality, there is also a reduction in muscle mass that is consistently occurring during aging. The increase in oxidative stress and chronic inflammation that commonly occurs in the aging process apparently also plays a role in the development of decreased muscle mass and strength (Mainous et al., 2015). The decrease in muscle mass in the elderly corresponds to a 10% reduction in grip strength per decade, starting from the age of 40 years (Jaafar et al., 2023). Skeletal muscle plays an important role in glucose metabolism and has a significant influence on insulin sensitivity. Increased insulin resistance in older adults may be closely associated with skeletal muscle aging. A reduction in GLUT4 expression as a result of a decrease in muscle volume causes a reduction in insulin sensitivity in aging skeletal muscle (Joo et al., 2022).

The results of this study showed a correlation of waist circumference and hip circumference with handgrip strength. This is in line with the study of Widjaja et al. (Widjaja et al., 2018), who stated that there was a significant correlation of waist circumference and hip circumference with handgrip strength ($p=<0.001$, $r=0.302$; and $p=<0.001$, $r=0.296$) A greater waist circumference is associated with a greater handgrip strength in males (Hardy et al., 2013).

In the multiple regression analysis of HGS, we removed the data on body weight because of the occurrence of multicollinearity between weight and BMI, with a correlation coefficient of more than 0.9, indicating an extremely strong relationship between these two variables. Conceptually, only one of the variables is used in multivariate analysis. The multiple regression analysis included age, height, BMI, waist circumference, and hip circumference, with HGS as dependent variable in a stepwise dependent manner. After three iterations, only height, BMI, and hip circumference played a role in predicting HGS by means of the regression formula, which resulted in $R^2=0.19$. This signifies that for known values of height, BMI, and hip circumference, we can predict the HGS value 19% more accurately than without a knowledge of these data. For a clinical diagnosis, a minimum increase of 10% is needed. This study found that height, BMI, and hip circumference play a role in predicting handgrip strength through the regression formula, i.e., handgrip strength = - 36.98 + 0.48 x height + 0.79 x BMI – 0.29 x hip circumference. Handgrip strength and waist circumference are surrogate muscle strength and visceral adiposity markers, respectively (Nakanishi et al., 2024). Waist circumference is also more sensitive in determining body fat distribution, particularly in the abdomen. Waist circumference correlates better with abdominal fat distribution than BMI (Rokhmah et al., 2015). Waist circumference and hip circumference are associated with obesity, in which the fat content is higher, and the skeletal muscle and fascicular content is lower, thereby resulting in a lower contractile capacity of skeletal muscle (Afaq et al., 2019).

The limitation of this study is that it did not evaluate other factors that may affect handgrip strength, such as nutrient intake. From the anthropometric measures of the hands and feet in this study, the causes and effects of the decrease in handgrip strength could not be determined because this study used a cross-sectional design.

CONCLUSION

There are three factors that may be used to estimate handgrip strength in PWP, namely height, BMI, and hip circumference, whereas blood glucose concentration is not correlated with handgrip strength in PWP. It is recommended to pay attention to height, BMI, and hip circumference,

particularly in the acceptance criteria of PWP candidates, and to conduct further studies with consideration of other factors that affect handgrip strength, such as food intake and anthropometric features of the hands and arms.

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REFERENCES

Afaq, E., Hassan, S.H., Khan, M.R., Zaidi, D.A., & Baktashi, H., 2019. Correlation of Hand Dynamometry With Body Mass Index and Waist Hip Ratio in Medical Students. Pak J Physiol,15, pp.19-21.

Agtuahene, M.A., Quartey, J., & Kwakye, S., 2023. Influence of Hand Dominance, Gender, and Body Mass Index on Hand Grip Strength. S Afr J Physiother, 79, pp.1-6. doi: org/10.4102/sajp.v79i1.1923.

Al-Asadi, J.N., 2018. Handgrip Strength in Medical Students: Correlation with Body Mass Index and Hand Dimensions. Asian Journal of Medical Sciences, 9, pp.21-26. doi: 10.3126/ajms.v9i1.18577.

Badan Pusat Statistik Kota Administrasi Jakarta Barat., 2020. Kecamatan Cengkareng Dalam Angka, pp. 1-114.

Chen, D., Zhu, Y., Ni, W., Li, Y., Yin, G., Shao, Z., & Zhu, J., 2023. Hand Grip Strength is Inversely Associated with Total Daily Insulin Dose Requirement in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study. PeerJ, pp.1-13. doi: 10.7717/peerj.15761.

Cooper, R., Tomlinson, D., Hamer, M., & Pereira, S.M.P., 2022. Lifetime Body Mass Index and Grip Strength at Age 46 Years: The 1970 British Cohort Study. J Cachexia Sarcopenia Muscle, 13, pp.1-10. doi: 10.1002/jcsm.12992.

Fauzi, L., Handayani, O.W.K., Susilo, M.T., Kurnia, A.R., Rahayu, S.R., Irawan, F.A., Horng Lu, F.J., Lin, C., Lai, M.F., & Yu, Y.C., 2022. Obesity in Indonesian and Taiwanese Adolescents Related to Self Perception, Diet, Exercise and Body Image. KEMAS, 17(3):pp.453-461. doi: 10.15294/kemas.v17i3.34396

Gamayanti, K.A.V., Aryana, I.G.P.S., & Gotera, W., 2023. Hubungan Antara Kekuatan Genggaman Tangan Dengan Kadar Gula Darah Sewaktu Pada Lansia Di Desa Melinggih, Kecamatan Payangan, Kabupaten Gianyar. Intisari Sains Medis, 14(2): pp.483-488.

Giglio, B.M., Mota, J.F., Wall, B.T., & Pimentel, G.D., 2018. Low Handgrip Strength is Not Associated With Type 2 Diabetes Mellitus and Hyperglycemia: A Population-Based Study. Clin Nutr Res, 7(2): pp.112-116. doi: 10.7762/cnr.2018.7.2.112.

Hammed, A.I., & Obaseki, C.O., 2017. Interdependence of Body Mass Index with Handgrip Strength and Endurance Among Apparently Healthy Teenagers. Turk J Kin, 4, pp.1-7.

Handayani, M.D.N., Sadewa, A.H., Farmawati, A., & Rochmah, W., 2018. Anthropometric Prediction Equations for Estimating Muscle Mass of Elderly Women. KEMAS, 14(2):pp.195-204. doi: 10.15294/kemas.v14i2.14073

Hardy, R., Cooper, R., Sayer, A.A., Shlomo, Y.B., Cooper, C., Deary, I.J., Demakakos, P., Gallacher, J., Martin, R.M., McNeill, G., et al., 2013. Body Mass Index, Muscle Strength and Physical Performance in Older Adults From Eight Cohort Studies: The Halcyon Programme. PLoS One, 8(2): pp.e56483. doi: 10.1371/journal.pone.0056483.

Heidy., Djuartina, T., & Irawan, R., 2019. Korelasi Kekuatan Genggaman Tangan Dengan Karakter Antropometri Lengan Bawah dan Tangan Serta Indeks Massa Tubuh. Damianus Journal of Medicine,18, pp.1-7.

Ilmi, A.F., & Utari, D.M., 2020. Hubungan Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul (RLPP) Terhadap Kadar Glukosa Darah Puasa Pada Mahasiswa. Journal of Nutrition College, 9, pp.222-227.

Jaafar, M.H., Ismail, R., Ismail, N.H., Isa, Z.M., Tamil, A.M., Nasir, N.M., Keat, N.K., Razak, N.H., Abidin, N.Z., & Yusof, K.H., 2023. Normative Reference Values and Predicting Factors of Handgrip Strength For Dominant and Non-Dominant Hands Among Healthy Malay Adults in Malaysia. BMC Musculoskelet Disord, 24, pp. 1-9. doi: 10.1186/s12891-023-06181-8.

Joo, K.C., Son, D.H., & Park, J.M., 2022. Association Between Relative Handgrip Strength and Insulin Resistance in Korean Elderly Men Without Diabetes: Findings Of The 2015 Korea National Health Nutrition Examination Survey. Korean J Fam Med, 43, pp.199-205. doi:10.4082/kjfm.21.0138.

Krakauer, N.Y., & Krakauer, J.C., 2020. Association of Body Shape Index (ABSI) with Hand Grip Strength. Int J Environ Res Public Health,17, pp.1-12. doi: doi:10.3390/ijerph17186797.

Kurniawan, A., Widjaja, D., & Lugito, N.P.H., 2018. Mean and Cutoff Value of Hand Grip Strength For Healthy Indonesian Young Adults. World Congress on Osteoporosis, Osteoartritis and Musculoskeletal Diseases; Krakow, Poland.

Leong, D.P., Teo, K.K., Rangarajan, S., Kutty, R., Lanas, F., Hui, C., Quanyong, X., Zhenzhen, Q., Jinhua, T., Noorhassim, I., et al., 2016. Reference Ranges of Handgrip Strength From 125,462 Healthy Adults in 21 Countries: A Prospective Urban Rural Epidemiologic (PURE) Study. J Cachexia Sarcopenia Muscle,7, pp.535-546. doi: 10.1002/jcsm.12112.

Mainous, A.G., Tanner, R.J., Anton, S.D., & Jo, A., 2015. Grip Strength as A Marker of Hypertension and Diabetes in Healthy Weight Adults. Am J Prev Med, 49(6): pp.850-858. doi: 10.1016/j.amepre.2015.05.025.

Manoharan, V.S., Sundaram, S.G., & Jason, J.I., 2015. Factors Affecting Hand Grip Strength and Its Evaluation: A Systemic Review. Int J Physiother Res, 3(6): pp.1288-1293. doi:10.16965/ijpr.2015.193.

McGrath, R., Johnson, N., Klawitter, L., Mahoney, S., Trautman, K., Carlson, C., Rockstad, E., & Hackney, K.J., 2020. What Are The Association Patterns Between Handgrip Strength and Adverse Health Conditions? A Topical Review. SAGE Open Medicine, 8, pp.1-12. doi:10.1177/2050312120910358.

Nakanishi, S., Shimoda, M., Kimura, T., Sanada, J., Fushimi, Y., Iwamoto, Y., Iwamoto, H., Dan, K., Mune, T., Kaku, K., et al., 2024. The Impact of Handgrip Strength and Waist Circumference on Glycemic Control: Prospective, Observational Study Using Outpatient Clinical Data in Japanese Patients With Type 2 Diabetes Mellitus. J Diabetes Investig, 15(7): pp.892-898. doi: 10.1111/jdi.14200.

Nathania, N.P.S., Nugraha, M.H.S., Primayanti, I.D.A., & Saraswati, P.A.S., 2023. Handgrip Strength is Associated With Balance in Elderly Women. Majalah Ilmiah Fisioterapi Indonesia, 11, pp.70-75.

Peraturan Gubernur Provinsi Daerah Khusus Ibukota Jakarta Nomor 7 tahun 2017 Tentang Penanganan Prasarana dan Sarana Umum Tingkat Kelurahan. Jakarta 2017.

Richter, E.A., & Hargreaves, M., 2013. Exercise, GLUT4, and Skeletal Muscle Glucose Uptake. Physiol Rev, 93(3): pp.993-1017. doi: 10.1152/physrev.00038.2012.

Rokhmah, F.D., Handayani, D., & Al-Rasyid, H., 2015. Korelasi Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul Terhadap Kadar Glukosa Plasma Menggunakan Tes Toleransi Glukosa Oral. Jurnal Gizi Klinik Indonesia,12, pp.28-35.

Rondhianto., Ridla, A.Z., & Hasan, H., 2024. Sociodemographic Factors Affecting Diabetic Dietary Behavior in People with Type 2 Diabetes Mellitus. KEMAS, 19(3):pp.429-437. doi: 10.15294/kemas.v19i3.37856

Safitri, I., Setyarsih, L., Susanto, H., Suhartono., & Fitranti, D.Y., 2020. The Effect of Low and High Glycemic Load Diet on Muscle Fatigue of Young Soccer. KEMAS, 16(1):pp.111-120. doi: 10.15294/kemas.v16i1.23508

Schrager, M.A., Metter, E.J., Simonsick, E., Ble, A., Bandinelli, S., Lauretani, F., & Ferrucci, L., 2007. Sarcopenic Obesity and Inflammation in The Inchianti Study. J Appl Physiol, 102(3): pp.919-925. doi: 10.1152/japplphysiol.00627.2006.

Sirajudeen, M.S., Shah, U.N., Pillai, P.S., Mohasin, N., & Shantaram, M., 2012. Correlation Between Grip Strength and Physical Factors in Men. International Journal of Health and Rehabilitation Sciences, 1, pp.58-63.

Soenyoto, T., Mollap, K., & Mungpong, J., 2017. Correlation of Energy and Protein Consumption Levels with Physical Endurance of Rhythmic Gymnast Athletes. KEMAS, 13(1):pp.131-136. doi: 10.15294/kemas.v13i1.9888

Soraya, N., & Parwanto, E., 2023. The Controversial Relationship Between Body Mass Index and Handgrip Strength in The Elderly: An Overview. Malays J Med Sci, 30, pp.73-83.

Vaishya, R., Misra, A., Vaish, A., Ursino, N., & D'Ambrosi, R., 2024. Hand Grip Strength as A Proposed New Vital Sign Of Health: A Narrative Review of Evidences. Journal of Health, Population and Nutrition, 43, pp.1-14. doi:10.1186/s41043-024-00500-y.

Widjaja, D., Tjhai, K., Dermawan, K., Kalim, J., Tanzil, S., Pramusinta, A., Phenca, H.K., Kurniawan, A., 2018. Correlations Between Hand Grip Strength and Anthropometric Status in Young Indonesian Adults. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.

Zaccagni, L., Toselli, S., Bramanti, B., Gualdi-Russo, E., Mongillo, J., & Rinaldo, N., 2020. Handgrip Strength in Young Adults: Association With Anthropometric Variables and Laterality. Int J Environ Res Public Health, 17, pp.1-18. doi:10.3390/ijerph17124273.

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Handgrip Strength of Public Works Personnel in West Jakarta

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Abstract

Public Works Personnel (PWP) in Jakarta perform their routine duties manually instead of using equipment. Handgrip strength (HGS) measures maximum hand strength as a quality indicator for muscle strength and mass. Factors affecting muscle strength are age, sex, body mass index (BMI), waist circumference (WC), and hip circumference (HC). Increased fasting blood glucose (FBG) is also associated with muscle quality, muscle strength, and physical performance. This study aimed to determine the factors associated with handgrip strength in PWP. A total of 192 male PWP from the Cengkareng district were recruited by simple random sampling. The collected data were demographics, BMI, FBG, WC, HC, and HGS. Statistical analysis was done using Pearson's correlation test and multiple regression analysis. There was a significant positive correlation of BMI, WC, and HC with HGS (p=0.006; r=0.20, p=0.009; r=0.19, and p=0.005; r=0.20) and a significant negative correlation between age and HGS (p=0.008; r=-0.19) but not between FBG and HGS (p=0.847). Multiple regression analysis showed height, BMI, and HC positively predicting HGS (R2=0.19). Handgrip strength of public works personnel is associated with BMI, age, waist circumference, and hip circumference, but not with fasting blood glucose. Height, BMI, and hip circumference predict handgrip strength

Introduction

Personnel for the management of public infrastructure and facilities at the village level are workers who manage village public works for a given time period on the basis of a work order. The tasks of village-level public works personnel (PWP) consist of managing the infrastructure and facilities, such as streets, drains, and parks, including installed lights (Gubernur Provinsi Daerah Khusus Ibukota Jakarta, 2017). The work performed by village PWP consists mainly of intense physical activity involving the hands, such that handgrip strength is essential in their tasks. Lowering of handgrip strength may indicate reduced muscle strength, which may especially interfere with the daily activities of village PWP that consist mainly of manual labor.

Handgrip strength measures maximal hand strength and indicates muscle quality that reflects muscle strength and mass. Muscle strength refers to the ability of muscle groups to raise a given load. Low or poor grip strength is frequently associated with damaging health impacts, such as chronic disease, and is the initial sign of reduced muscle mass, limitations in physical functions, and mortality risk. Poor handgrip strength may also reduce a person's ability to perform activities of daily living and, therefore, impact quality of life (Soraya *et al*., 2023; Nathania *et al*., 2023). Muscle mass accounts for approximately 40% of total weight, such that knowledge of muscle mass conditions is essential in maintaining health and activities (Handayani *et al*., 2018).

Handgrip strength may represent the strength of all muscles in the body. Several factors possibly influencing an individual's muscle strength are age, sex, and body mass index (BMI) (Soraya *et al*., 2023). Obesity may also affect BMI. Obesity in adults is not only associated with genetic factors but also with

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environmental factors during development (Fauzi *et al*., 2022). Handgrip strength is also associated with chronic diseases such as diabetes, metabolic syndrome, and cardiovascular disease. Increased glucose concentration is also associated with disorders of muscle quality and strength, as well as physical performance (Chen *et al*., 2023). A reduction in muscle mass also affects an individual's strength and physical endurance. A combination of proteins can maintain muscle function, thereby building body strength and physical endurance (Soenyoto *et al*., 2017). In the present study, we included fasting blood glucose concentrations in the data collection to obtain more accurate measures of glucose concentrations that have not yet been influenced by food intake.

Handgrip strength may be a health indicator that provides information on a person's health (Vaishya *et al*., 2024). However, its clinical significance in determining the prevention and treatment of poor handgrip remains limited because of the still unclear etiology of muscle weakness, especially because the clinical outcomes associated with handgrip strength are extremely diverse (McGrath *et al*., 2020). The relationship between BMI and handgrip strength is still controversial, with several investigators finding a significant positive association and others reporting a non-significant relationship (Al Asadi, 2018). There are few studies on handgrip strength, especially on workers in the sanitation sector, such as public works personnel, which is why the present investigators were interested in studying this topic. The present study aimed to determine the factors associated with handgrip strength in public works personnel.

Method

This cross-sectional study involving male public works personnel in Cengkareng District, West Jakarta, was conducted from September to October 2024. The study sample was selected by simple random sampling. Calculation of the sample size for a correlation with r=0.2, Zα=0.05, and Zβ=0.1 resulted in a sample of 192 subjects who met the inclusion criterion of being male and 25-60 years old, and the exclusion criteria of having an abnormality of the hands, heart disease, pulmonary disease, and malignancies.

Measurements were obtained on height in cm, weight in kg, as well as waist circumference and hip circumference in cm. Height and weight were determined using microtoise and digital scales, respectively. BMI was calculated using the formula of weight divided by height squared. Measurement of waist and hip circumferences was done using a measuring tape. Waist circumference was determined with the subject in the upright position, at the end of a normal expiration, at the smallest abdominal circumference between the iliac crest and twelfth rib. The cut-off values for waist circumference in males and females are ≥ 90 cm and ≥ 80 cm, respectively. Hip circumference was measured using a measuring tape that was applied around the hips at the level of the symphysis pubis and the maximal gluteal circumference (Ilmi *et al*., 2020).

Fasting blood glucose (FBG) concentration was determined on venous blood by the hexokinase method after the respondents had fasted for approximately 10 hours prior. Handgrip strength was measured with a handgrip strength dynamometer to the nearest kilogram as follows: The respondent was asked to sit down comfortably without reclining and with the feet completely relaxed. The hips and knees were positioned at a 90^0 angle, the gripping hand with the shoulder in adduction, the elbow flexed 90^0, and the forearm and wrist in the neutral position. The gripping duration was 3 seconds. The respondent gripped the instrument with the dominant hand as hard as possible, and the value indicated by the needle was recorded. In accordance with the protocol recommended by the American Society of Hand Therapists (ASHT), the recorded handgrip strength was the average of three handgrip strength tests (Nathania *et al*., 2023).

Before data analysis by means of the correlation test, the normality of the data distribution was determined using the Kolmogorov-Smirnov test. The Pearson correlation test was used for a normal data distribution, whereas for a non-normal data distribution, the Spearman correlation test was done, followed by a multiple regression analysis. Ethics approval was issued by the Ethics Committee of the Faculty of Medicine,

Universitas Trisakti, under No. 033/KER/FK/08/2024.

Result and Discussion

In this study, the respondents comprised 192 male public works personnel of Cengkareng District who consisted of the villages (subdistricts) of Kedaung, Duri Kosambi, West Cengkareng, Kapuk, and Rawa Buaya. A total of 26% of the respondents were residents of Duri Kosambi, where Muslims comprised 98.4% of the population. The majority of the respondents, at 77.6% had an educational level of senior high school. Nearly all of the respondents, or 99%, were right-handed, using the right hand as the dominant one at work, and most were of the Betawi (Jakarta) ethnic group at 51.6% (Table 1).

Table 1. Demographic Data of the Respondents

Characteristic	**N (%)**
Village	
Kedaung	40 (20.8)
Duri Kosambi	50 (26)
Cengkareng Barat	33 (17.2)
Kapuk	43 (22.4)
Rawa Buaya	26 (13.5)
Religion	
Islamic	189 (98.4)
Christian	2 (1)
Catholic	1 (0.5)
Level of education	
Elementary school	7 (3.6)
Junior high school	29 (15.1)
Senior high school	149 (77.6)
Academy-University	7 (3.6)
Dominant hand	
Right hand	190 (99)
Left hand	2 (1)
Ethnic group	
Javanese	53 (27.6)
Betawi	99 (51.6)
Sundanese	25 (13)
Other	14 (7.3)

Legend: Other ethnicities comprised groups from Palembang, Lampung, Bima, and Kupang
Source: primary data 2024 (questionnaires and interviews with respondents)

Table 2. Respondents' Characteristics

Variable	**Mean ± SD**
Age (years)	40.9 ± 8.9
Height (cm)	164.6 ± 6.7
Weight (kg)	64.7 ± 13.1
BMI (kg/m^2)	23.8 ± 4.3
Waist circumference (cm)	85.4 ± 10.4
Hip circumference (cm)	96.9 ± 8.4

HGS (kg)	33.1 ± 6.9
FBG (mg/dL)	87 (64-280)*

Legend: BMI: body mass index. *FBG: fasting blood glucose, expressed as Median (Min-Max).
HGS: handgrip strength
Source: primary data (respondents' measurements)

Table 3. Analysis of the Relationship of Age, Height, Weight, BMI, Waist Circumference, Hip Circumference, and Fasting Blood Glucose Concentration with Handgrip Strength

Variable	R	P value
Age	- 0.19	0.008*
Height	0.36	0.000*
Weight	0.32	0.000*
BMI	0.20	0.006*
Waist circumference	0.19	0.009*
Hip circumference	0.20	0.005*
FBG	0.02	0.847#

*P value with Pearson's test, # Spearman's test
Source: primary data

Table 4. Multiple Regression Analysis on Handgrip Strength

Determinant	b	SE	p
Height	0.48	0.08	0.000
BMI	0.79	0.22	0.000
Hip circumference	- 0.29	0.12	0.015
Constant	- 36.98		

R^2=0,19
Source: primary data

The bivariate analysis found a significant positive correlation of BMI, height, weight, waist circumference, and hip circumference with handgrip strength (p=0.006, r=0.20; p=<0.001, r=0.36; p=<0.001, r=0.32; p=0.009, r=0.19; p=0.005; r=0.20, respectively). This showed that the larger the BMI, height, weight, waist circumference, and hip circumference, the stronger the handgrip. However, there was no significant relationship between fasting glucose concentration and handgrip strength (p=0.847). This study also found that age had a significant negative correlation with handgrip strength (p=0.011; r=-0.182), signifying that the older a person, the lower the handgrip strength (Table 3). Results of multiple regression analysis on handgrip strength are listed in Table 4.

This study found that most of the public works personnel in Duri Kosambi village were Muslims, had a senior high school level of education, and were of Betawi ethnicity. This was in line with the demographic data in the Cengkareng district, in that Duri Kosambi was the village with the greatest area, most of the residents were male, and the Islamic religion had the most believers (Badan Pusat Statistik Jakarta Barat, 2020). Among our respondents, more than ten percent were in the diabetes category. Socio-demographic factors capable of affecting dietary habits in patients with diabetes are the level of education and the type of family (Rondhianto *et al*., 2024). Among the respondents of this study, the dominant right hand was used for working. In the adult population, a total of 90% of the residents preferred to use the right hand for manual tasks, whereas around 10% used the left hand (Zaccagni *et al*., 2020). According to Agtuahene *et al.* (Agtuahene *et al*., 2023), the dominant hand is generally around 10% stronger than the non-dominant hand. Many activities in daily life need a high level of exertion of the muscles of the hand and forearm (Hammed *et al*., 2017). The frequent use of the dominant hand in daily living results in the muscles of the hand and forearm providing strength in gripping (Afaq *et*

al., 2019).

The mean handgrip strength in this study was 33.1 ± 6.9 kg, which is relatively low if compared with the study results of Kurniawan *et al*. (Kurniawan *et al*., 2018). In healthy young Indonesian adults, the mean handgrip strength in males was 37.37 ± 8.29 kg, and the lower limit of muscle strength in Indonesian males was 20.79 kg. The handgrip strength results in both studies are still below those of males in other Southeast Asian countries, according to the study results of Leong *et al*. (Leong *et al*., 2016). These investigators found that the mean handgrip strength in Southeast Asian males aged 35-40 years was 40 kg (34-44 kg); for the age range of 41-50 years, the handgrip strength was 38 kg (33-44 kg), for the age range of 51-60 years it was 34 kg (30-40 kg), and for ages 61-70 years 30 kg (24-34 kg). This may have been caused by ethnic differences mediated by genetic differences that also affect individual muscle strength. The highest handgrip strength is found in the European and North American populations, whereas the lowest handgrip strength is found in African, South Asian, and Southeast Asian populations. These variations in muscle strength in various countries may also be partly caused by differences in socio-economic status (Leong *et al*., 2016).

According to Agtuahene *et al*. (Agtuahene *et al*., 2023), handgrip strength is a physiological variable influenced by several factors, such as age, sex, and body measurements. In contrast, according to Zaccagni *et al*. (Zaccagni *et al*., 2020), handgrip strength, apart from being affected by age, may also be influenced by physical activity, grip measurement, height, and body mass. The present study found a significant positive correlation between BMI and handgrip strength. According to Hammed *et al*., this may be caused by the higher percentage of skeletal muscle mass compared to the percentage of fat mass, thereby resulting in a higher handgrip strength [13]. Our study's results are identical to those of Agtuahene *et al*. (Agtuahene *et al*., 2023), who found a significant positive correlation (r=0.290) of handgrip strength with BMI and height. This shows that taller individuals with higher BMI apparently have greater handgrip strength. Our study is also in line with the study of Krakauer in 2020, which showed a positive correlation between BMI and handgrip strength (Krakauer *et al*., 2020).

The study of Cooper *et al*. (Cooper *et al*., 2022) concluded that a high childhood BMI is associated with higher grip strength at age 46 years. This is because fat mass acts as a mechanical load that elicits an anabolic response that stimulates muscle growth and function. This anabolic response is usually greater in males than in females because of the higher testosterone concentration. However, it should also be noted that BMI does not differentiate between fat mass and lean mass as adipocyte indicators that may vary with sex. It should be noted that BMI is a measure of body fat that does not differentiate between weight changes because of an increase or decrease in muscle mass or body fat (Zaccagni *et al*., 2020). According to Jafar *et al*. (Jaafar *et al*., 2023), heavier individuals have a greater muscle mass, resulting in greater handgrip strength, than lighter individuals. In the study of Heidy *et al*. (Heidy *et al*., 2019), the investigators found a positive correlation between height and forearm length. The study by Sirajudeen *et al*. (Sirajudeen *et al*., 2012) found a positive correlation between hand length and handgrip strength. This shows that height affects the longer extremity or arm, thus approaching optimal muscle length that may result in greater grip strength. According to a prospective cohort study, handgrip strength in middle age appears to be associated with birth weight and the increase in height at puberty. Pubertal growth and handgrip strength possibly represent the development of muscle size and growth (Schrager *et al*., 2007).

Our study found no relationship between blood glucose concentration and handgrip strength. Our study agrees with the study of Giglio *et al*. (Giglio *et al*., 2018), which showed no significant relationship between muscle mass strength and blood glucose concentration. According to Giglio, this is because most respondents are individuals who routinely perform structured physical activity, even though they are in the light category. This is similar to our study respondents, who were public works personnel and who had performed physical activity such as street sweeping and cleaning storm drains. Glucose is the main fuel

for muscle contraction, entering the muscle cells by diffusion through the GLUT4 glucose transporter, which, after muscle contraction, moves from its intracellular storage site to the plasma membrane and T-tubules (Richter *et al*., 2013). Glucose metabolism has an influence on handgrip strength through various mechanisms, such as disorders of glucose metabolism, particularly glycogenolysis, that may result in the loss of muscle strength. Insulin resistance in hyperglycemia may cause muscle degradation because hyperglycemia causes low muscle strength through effects on skeletal muscle mitochondria. The lowering of muscle strength by hyperglycemia occurs through Krüppel-like factor 15, which regulates skeletal muscle lipid flux. Hyperglycemia also increases pro-inflammatory cytokines, which may increase the catabolism that plays a role in the further decrease in muscle mass and quality (Gamayanti *et al*., 2023). The amount of carbohydrates also influences the glycemic response and post-prandial insulin level, impacting the supply of glycogen to the muscles (Safitri *et al*.,2020).

This study has a significant negative correlation between age and handgrip strength, which decreases with age (Manoharan *et al*., 2015). Handgrip strength initially experiences an increase with increasing age, reaches its peak between the ages of 30 and 40 years, and decreases afterward (Zaccagni *et al*., 2020). The age-related changes in skeletal muscle composition, particularly the accumulation of lipids in skeletal muscle fibers, play a role in the poor quality of the muscles and may result in metabolic abnormalities such as insulin resistance. Apart from changes in muscle quality, there is also a reduction in muscle mass that consistently occurs during aging. The increase in oxidative stress and chronic inflammation that commonly occurs in the aging process apparently also plays a role in the development of decreased muscle mass and strength (Mainous *et al*., 2015). The decrease in muscle mass in the elderly corresponds to a 10% reduction in grip strength per decade, starting from the age of 40 years (Jaafar *et al*., 2023). Skeletal muscle plays an important role in glucose metabolism and has a significant influence on insulin sensitivity. Increased insulin resistance in older adults may be closely associated with skeletal muscle aging. A reduction in GLUT4 expression as a result of a decrease in muscle volume causes a reduction in insulin sensitivity in aging skeletal muscle (Joo *et al*., 2022). The results of this study showed a correlation of waist circumference and hip circumference with handgrip strength. This is in line with the study of Widjaja *et al*. (Widjaja *et al*., 2018), who stated that there was a significant correlation of waist circumference and hip circumference with handgrip strength ($p=<0.001$, $r=0.302$; and $p=<0.001$, $r=0.296$) A greater waist circumference is associated with a greater handgrip strength in males (Hardy *et al*., 2013).

In the multiple regression analysis of HGS, we removed the data on body weight because of the occurrence of multicollinearity between weight and BMI, with a correlation coefficient of more than 0.9, indicating an extremely strong relationship between these two variables. Conceptually, only one of the variables is used in multivariate analysis. The multiple regression analysis included age, height, BMI, waist circumference, and hip circumference, with HGS as the dependent variable in a stepwise manner. After three iterations, only height, BMI, and hip circumference played a role in predicting HGS by means of the regression formula, which resulted in $R^2=0.19$. This signifies that for known values of height, BMI, and hip circumference, we can predict the HGS value 19% more accurately than without knowledge of these data. For a clinical diagnosis, a minimum increase of 10% is needed. This study found that height, BMI, and hip circumference play a role in predicting handgrip strength through the regression formula, i.e., handgrip strength = - 36.98 + 0.48 x height + 0.79 x BMI – 0.29 x hip circumference. Handgrip strength and waist circumference are surrogate muscle strength and visceral adiposity markers, respectively (Nakanishi *et al*., 2024). Waist circumference is also more sensitive in determining body fat distribution, particularly in the abdomen. Waist circumference correlates better with abdominal fat distribution than BMI (Rondhianto *et al*., 2024). Waist circumference and hip circumference are associated with obesity, in which the fat content is higher, and

the skeletal muscle and fascicular content is lower, thereby resulting in a lower contractile capacity of skeletal muscle (Afaq *et al*., 2019). The limitation of this study is that it did not evaluate other factors that may affect handgrip strength, such as nutrient intake. From the anthropometric measures of the hands and feet in this study, the causes and effects of the decrease in handgrip strength could not be determined because this study used a cross-sectional design.

Conclusion

Three factors may be used to estimate handgrip strength in PWP, namely height, BMI, and hip circumference, whereas blood glucose concentration is not correlated with handgrip strength in PWP. It is recommended to pay attention to height, BMI, and hip circumference, particularly in the acceptance criteria of PWP candidates, and to conduct further studies with consideration of other factors that affect handgrip strength, such as food intake and anthropometric features of the hands and arms.

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References

Afaq, E., Hassan, S.H., Khan, M.R., Zaidi, D.A., & Baktashi, H., 2019. Correlation of Hand Dynamometry With Body Mass Index and Waist-Hip Ratio in Medical Students. *Pak J Physiol*.,15, pp.19-21.

Agtuahene, M.A., Quartey, J., & Kwakye, S., 2023. Influence of Hand Dominance, Gender, and Body Mass Index on Hand Grip Strength. *S Afr J Physiother.*, 79, pp.1-6.

Al-Asadi, J.N., 2018. Handgrip Strength in Medical Students: Correlation with Body Mass Index and Hand Dimensions. *Asian Journal of Medical Sciences*, 9, pp.21-26.

Badan Pusat Statistik Kota Administrasi Jakarta Barat., 2020. *Kecamatan Cengkareng Dalam Angka*, pp.1-114.

Chen, D., Zhu, Y., Ni, W., Li, Y., Yin, G., Shao, Z., & Zhu, J., 2023. Hand Grip Strength is Inversely Associated with Total Daily Insulin Dose Requirement in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study. *PeerJ*., pp.1-13.

Cooper, R., Tomlinson, D., Hamer, M., & Pereira, S.M.P., 2022. Lifetime Body Mass Index and Grip Strength at Age 46 Years: The 1970 British Cohort Study. *J Cachexia Sarcopenia Muscle*, 13, pp.1-10.

Fauzi, L., Handayani, O.W.K., Susilo, M.T., Kurnia, A.R., Rahayu, S.R., Irawan, F.A., Horng Lu, F.J., Lin, C., Lai, M.F., & Yu, Y.C., 2022. Obesity in Indonesian and Taiwanese Adolescents Related to Self Perception, Diet, Exercise, and Body Image. *KEMAS*, 17(3), pp.453-461.

Gamayanti, K.A.V., Aryana, I.G.P.S., & Gotera, W., 2023. Hubungan Antara Kekuatan Genggaman Tangan Dengan Kadar Gula Darah Sewaktu Pada Lansia Di Desa Melinggih, Kecamatan Payangan, Kabupaten Gianyar. *Intisari Sains Medis*, 14(2), pp.483-488.

Giglio, B.M., Mota, J.F., Wall, B.T., & Pimentel, G.D., 2018. Low Handgrip Strength is Not Associated With Type 2 Diabetes Mellitus and Hyperglycemia: A Population-Based Study. *Clin Nutr Res*., 7(2), pp.112-116.

Hammed, A.I., & Obaseki, C.O., 2017. Interdependence of Body Mass Index with Handgrip Strength and Endurance Among Apparently Healthy Teenagers. *Turk J Kin*., 4, pp.1-7.

Handayani, M.D.N., Sadewa, A.H., Farmawati, A., & Rochmah, W., 2018. Anthropometric Prediction Equations for Estimating Muscle Mass of Elderly Women. *KEMAS*, 14(2),pp.195-204.

Hardy, R., Cooper, R., Sayer, A.A., Shlomo, Y.B., Cooper, C., Deary, I.J., Demakakos, P., Gallacher, J., Martin, R.M., McNeill, G., Starr, J.M., Steptoe, A., Syddall, H., & Kuh, D., 2013. Body Mass Index, Muscle Strength, and Physical Performance in Older Adults From Eight Cohort Studies: The Halcyon Programme. *PLoS One*, 8(2), pp.e56483.

Heidy., Djuartina, T., & Irawan, R., 2019. Korelasi Kekuatan Genggaman Tangan Dengan Karakter Antropometri Lengan Bawah dan Tangan Serta Indeks Massa Tubuh. *Damianus Journal of Medicine*,18, pp.1-7.

Ilmi, A.F., & Utari, D.M., 2020. Hubungan Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul (RLPP) Terhadap Kadar Glukosa Darah Puasa Pada Mahasiswa. *Journal of Nutrition College*, 9, pp.222-227.

Jaafar, M.H., Ismail, R., Ismail, N.H., Isa, Z.M., Tamil, A.M., Nasir, N.M., Keat, N.K., Razak, N.H., Abidin, N.Z., & Yusof, K.H., 2023. Normative Reference Values and Predicting Factors of Handgrip Strength For Dominant

and Non-Dominant Hands Among Healthy Malay Adults in Malaysia. *BMC Musculoskelet Disord*., 24, pp.1-9.

Joo, K.C., Son, D.H., & Park, J.M., 2022. Association Between Relative Handgrip Strength and Insulin Resistance in Korean Elderly Men Without Diabetes: Findings Of The 2015 Korea National Health Nutrition Examination Survey. *Korean J Fam Med*., 43, pp.199-205.

Krakauer, N.Y., & Krakauer, J.C., 2020. Association of Body Shape Index (ABSI) with Hand Grip Strength. *Int J Environ Res Public Health*,17, pp.1-12.

Kurniawan, A., Widjaja, D., & Lugito, N.P.H., 2018. *Mean and Cutoff Value of Hand Grip Strength For Healthy Indonesian Young Adults*. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.

Leong, D.P., Teo, K.K., Rangarajan, S., Kutty, R., Lanas, F., Hui, C., Quanyong, X., Zhenzhen, Q., Jinhua, T., Noorhassim, I., AlHabib, K.F., Moss, S.J., Rosengren, A., Akalin, A.A., Rahman, O., Chifamba, J., Orlandini, A., Kumar, R., Yeates, K., Gupta, R., Yusufali, A., Dans, A., Avezum, A., Lopez-Jaramillo, P., Poirier, P., Heidari, H., Zatonska, K., Iqbal, R., Khatib, R., & Yusuf, S., 2016. Reference Ranges of Handgrip Strength From 125,462 Healthy Adults in 21 Countries: A Prospective Urban Rural Epidemiologic (PURE) Study. *J Cachexia Sarcopenia Muscle*,7, pp.535-546.

Mainous, A.G., Tanner, R.J., Anton, S.D., & Jo, A., 2015. Grip Strength as A Marker of Hypertension and Diabetes in Healthy Weight Adults. *Am J Prev Med*, 49(6), pp.850-858.

Manoharan, V.S., Sundaram, S.G., & Jason, J.I., 2015. Factors Affecting Hand Grip Strength and Its Evaluation: A Systemic Review. *Int J Physiother Res*., 3(6), pp.1288-1293.

McGrath, R., Johnson, N., Klawitter, L., Mahoney, S., Trautman, K., Carlson, C., Rockstad, E., & Hackney, K.J., 2020. What Are The Association Patterns Between Handgrip Strength and Adverse Health Conditions? A Topical Review. *SAGE Open Medicine*, 8, pp.1-12.

Nakanishi, S., Shimoda, M., Kimura, T., Sanada, J., Fushimi, Y., Iwamoto, Y., Iwamoto, H., Dan, K., Mune, T., Kaku, K., & Kaneto, H., 2024. The Impact of Handgrip Strength and Waist Circumference on Glycemic Control: Prospective, Observational Study Using Outpatient Clinical Data in Japanese Patients With Type 2 Diabetes Mellitus. *J Diabetes Investig*., 15(7), pp.892-898.

Nathania, N.P.S., Nugraha, M.H.S., Primayanti, I.D.A., & Saraswati, P.A.S., 2023. Handgrip Strength is Associated With Balance in Elderly Women. *Majalah Ilmiah Fisioterapi Indonesia*, 11, pp.70-75.

Gubernur Provinsi Daerah Khusus Ibukota Jakarta., 2017. *Peraturan Gubernur Provinsi Daerah Khusus Ibukota Jakarta Nomor 7 tahun 2017 Tentang Penanganan Prasarana dan Sarana Umum Tingkat Kelurahan*. Jakarta 2017.

Richter, E.A., & Hargreaves, M., 2013. Exercise, GLUT4, and Skeletal Muscle Glucose Uptake. *Physiol Rev*., 93(3), pp.993-1017.

Rondhianto., Ridla, A.Z., & Hasan, H., 2024. Sociodemographic Factors Affecting Diabetic Dietary Behavior in People with Type 2 Diabetes Mellitus. *KEMAS*, 19(3), pp.429-437.

Safitri, I., Setyarsih, L., Susanto, H., Suhartono., & Fitranti, D.Y., 2020. The Effect of Low and High Glycemic Load Diet on Muscle Fatigue of Young Soccer Athletes. *KEMAS*, 16(1), pp.111-120.

Schrager, M.A., Metter, E.J., Simonsick, E., Ble, A., Bandinelli, S., Lauretani, F., & Ferrucci, L., 2007. Sarcopenic Obesity and Inflammation in The Inchianti Study. *J Appl Physiol*., 102(3), pp.919-925.

Sirajudeen, M.S., Shah, U.N., Pillai, P.S., Mohasin, N., & Shantaram, M., 2012. Correlation Between Grip Strength and Physical Factors in Men. *International Journal of Health and Rehabilitation Sciences*, 1, pp.58-63.

Soenyoto, T., Mollap, K., & Mungpong, J., 2017. Correlation of Energy and Protein Consumption Levels with Physical Endurance of Rhythmic Gymnast Athletes. *KEMAS*, 13(1), pp.131-136.

Soraya, N., & Parwanto, E., 2023. The Controversial Relationship Between Body Mass Index and Handgrip Strength in The Elderly: An Overview. *Malays J Med Sci*., 30, pp.73-83.

Vaishya, R., Misra, A., Vaish, A., Ursino, N., & D'Ambrosi, R., 2024. Hand Grip Strength as A Proposed New Vital Sign Of Health: A Narrative Review of Evidences. *Journal of Health, Population and Nutrition*, 43, pp.1-14.

Widjaja, D., Tjhai, K., Dermawan, K., Kalim, J., Tanzil, S., Pramusinta, A., Phenca, H.K., Kurniawan, A., 2018. *Correlations Between Hand Grip Strength and Anthropometric Status in Young Indonesian Adults*. World

Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.

Zaccagni, L., Toselli, S., Bramanti, B., Gualdi-Russo, E., Mongillo, J., & Rinaldo, N., 2020. Handgrip Strength in Young Adults: Association With Anthropometric Variables and Laterality. *Int J Environ Res Public Health*, 17, pp.1-18.

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Handgrip Strength of Public Works Personnel in West Jakarta

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Abstract

Public Works Personnel (PWP) in Jakarta perform their routine duties manually instead of using equipment. Handgrip strength (HGS) measures maximum hand strength as a quality indicator for muscle strength and mass. Factors affecting muscle strength are age, sex, body mass index (BMI), waist circumference (WC), and hip circumference (HC). Increased fasting blood glucose (FBG) is also associated with muscle quality, muscle strength, and physical performance. This study aimed to determine the factors associated with handgrip strength in PWP. A total of 192 male PWP from the Cengkareng district were recruited by simple random sampling. The collected data were demographics, BMI, FBG, WC, HC, and HGS. Statistical analysis was done using Pearson's correlation test and multiple regression analysis. There was a significant positive correlation of BMI, WC, and HC with HGS (p=0.006; r=0.20, p=0.009; r=0.19, and p=0.005; r=0.20) and a significant negative correlation between age and HGS (p=0.008; r=-0.19) but not between FBG and HGS (p=0.847). Multiple regression analysis showed height, BMI, and HC positively predicting HGS (R2=0.19). Handgrip strength of public works personnel is associated with BMI, age, waist circumference, and hip circumference, but not with fasting blood glucose. Height, BMI, and hip circumference predict handgrip strength

Introduction

Personnel for the management of public infrastructure and facilities at the village level are workers who manage village public works for a given time period on the basis of a work order. The tasks of village-level public works personnel (PWP) consist of managing the infrastructure and facilities, such as streets, drains, and parks, including installed lights (Gubernur Provinsi Daerah Khusus Ibukota Jakarta, 2017). The work performed by village PWP consists mainly of intense physical activity involving the hands, such that handgrip strength is essential in their tasks. Lowering of handgrip strength may indicate reduced muscle strength, which may especially interfere with the daily activities of village PWP that consist mainly of manual labor.

Handgrip strength measures maximal hand strength and indicates muscle quality that reflects muscle strength and mass. Muscle strength refers to the ability of muscle groups to raise a given load. Low or poor grip strength is frequently associated with damaging health impacts, such as chronic disease, and is the initial sign of reduced muscle mass, limitations in physical functions, and mortality risk. Poor handgrip strength may also reduce a person's ability to perform activities of daily living and, therefore, impact quality of life (Soraya *et al*., 2023; Nathania *et al*., 2023). Muscle mass accounts for approximately 40% of total weight, such that knowledge of muscle mass conditions is essential in maintaining health and activities (Handayani *et al*., 2018).

Handgrip strength may represent the strength of all muscles in the body. Several factors possibly influencing an individual's muscle strength are age, sex, and body mass index (BMI) (Soraya *et al*., 2023). Obesity may also affect BMI. Obesity in adults is not only associated with genetic factors but also with

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environmental factors during development (Fauzi *et al*., 2022). Handgrip strength is also associated with chronic diseases such as diabetes, metabolic syndrome, and cardiovascular disease. Increased glucose concentration is also associated with disorders of muscle quality and strength, as well as physical performance (Chen *et al*., 2023). A reduction in muscle mass also affects an individual's strength and physical endurance. A combination of proteins can maintain muscle function, thereby building body strength and physical endurance (Soenyoto *et al*., 2017). In the present study, we included fasting blood glucose concentrations in the data collection to obtain more accurate measures of glucose concentrations that have not yet been influenced by food intake.

Handgrip strength may be a health indicator that provides information on a person's health (Vaishya *et al*., 2024). However, its clinical significance in determining the prevention and treatment of poor handgrip remains limited because of the still unclear etiology of muscle weakness, especially because the clinical outcomes associated with handgrip strength are extremely diverse (McGrath *et al*., 2020). The relationship between BMI and handgrip strength is still controversial, with several investigators finding a significant positive association and others reporting a non-significant relationship (Al Asadi, 2018). There are few studies on handgrip strength, especially on workers in the sanitation sector, such as public works personnel, which is why the present investigators were interested in studying this topic. The present study aimed to determine the factors associated with handgrip strength in public works personnel.

Method

This cross-sectional study involving male public works personnel in Cengkareng District, West Jakarta, was conducted from September to October 2024. The study sample was selected by simple random sampling. Calculation of the sample size for a correlation with r=0.2, Zα=0.05, and Zβ=0.1 resulted in a sample of 192 subjects who met the inclusion criterion of being male and 25-60 years old, and the exclusion criteria of having an abnormality of the hands, heart disease, pulmonary disease, and malignancies.

Measurements were obtained on height in cm, weight in kg, as well as waist circumference and hip circumference in cm. Height and weight were determined using microtoise and digital scales, respectively. BMI was calculated using the formula of weight divided by height squared. Measurement of waist and hip circumferences was done using a measuring tape. Waist circumference was determined with the subject in the upright position, at the end of a normal expiration, at the smallest abdominal circumference between the iliac crest and twelfth rib. The cut-off values for waist circumference in males and females are ≥ 90 cm and ≥ 80 cm, respectively. Hip circumference was measured using a measuring tape that was applied around the hips at the level of the symphysis pubis and the maximal gluteal circumference (Ilmi *et al*., 2020).

Fasting blood glucose (FBG) concentration was determined on venous blood by the hexokinase method after the respondents had fasted for approximately 10 hours prior. Handgrip strength was measured with a handgrip strength dynamometer to the nearest kilogram as follows: The respondent was asked to sit down comfortably without reclining and with the feet completely relaxed. The hips and knees were positioned at a 90^0 angle, the gripping hand with the shoulder in adduction, the elbow flexed 90^0, and the forearm and wrist in the neutral position. The gripping duration was 3 seconds. The respondent gripped the instrument with the dominant hand as hard as possible, and the value indicated by the needle was recorded. In accordance with the protocol recommended by the American Society of Hand Therapists (ASHT), the recorded handgrip strength was the average of three handgrip strength tests (Nathania *et al*., 2023).

Before data analysis by means of the correlation test, the normality of the data distribution was determined using the Kolmogorov-Smirnov test. The Pearson correlation test was used for a normal data distribution, whereas for a non-normal data distribution, the Spearman correlation test was done, followed by a multiple regression analysis. Ethics approval was issued by the Ethics Committee of the Faculty of Medicine,

Universitas Trisakti, under No. 033/KER/FK/08/2024.

Result and Discussion

In this study, the respondents comprised 192 male public works personnel of Cengkareng District who consisted of the villages (subdistricts) of Kedaung, Duri Kosambi, West Cengkareng, Kapuk, and Rawa Buaya. A total of 26% of the respondents were residents of Duri Kosambi, where Muslims comprised 98.4% of the population. The majority of the respondents, at 77.6% had an educational level of senior high school. Nearly all of the respondents, or 99%, were right-handed, using the right hand as the dominant one at work, and most were of the Betawi (Jakarta) ethnic group at 51.6% (Table 1).

Table 1. Demographic Data of the Respondents

Characteristic	**N (%)**
Village	
Kedaung	40 (20.8)
Duri Kosambi	50 (26)
Cengkareng Barat	33 (17.2)
Kapuk	43 (22.4)
Rawa Buaya	26 (13.5)
Religion	
Islamic	189 (98.4)
Christian	2 (1)
Catholic	1 (0.5)
Level of education	
Elementary school	7 (3.6)
Junior high school	29 (15.1)
Senior high school	149 (77.6)
Academy-University	7 (3.6)
Dominant hand	
Right hand	190 (99)
Left hand	2 (1)
Ethnic group	
Javanese	53 (27.6)
Betawi	99 (51.6)
Sundanese	25 (13)
Other	14 (7.3)

Legend: Other ethnicities comprised groups from Palembang, Lampung, Bima, and Kupang
Source: primary data 2024 (questionnaires and interviews with respondents)

Table 2. Respondents' Characteristics

Variable	**Mean ± SD**
Age (years)	40.9 ± 8.9
Height (cm)	164.6 ± 6.7
Weight (kg)	64.7 ± 13.1
BMI (kg/m^2)	23.8 ± 4.3
Waist circumference (cm)	85.4 ± 10.4
Hip circumference (cm)	96.9 ± 8.4

HGS (kg)	33.1 ± 6.9
FBG (mg/dL)	87 (64-280)*

Legend: BMI: body mass index. *FBG: fasting blood glucose, expressed as Median (Min-Max).
HGS: handgrip strength
Source: primary data (respondents' measurements)

Table 3. Analysis of the Relationship of Age, Height, Weight, BMI, Waist Circumference, Hip Circumference, and Fasting Blood Glucose Concentration with Handgrip Strength

Variable	R	P value
Age	- 0.19	0.008*
Height	0.36	0.000*
Weight	0.32	0.000*
BMI	0.20	0.006*
Waist circumference	0.19	0.009*
Hip circumference	0.20	0.005*
FBG	0.02	0.847#

*P value with Pearson's test, # Spearman's test
Source: primary data

Table 4. Multiple Regression Analysis on Handgrip Strength

Determinant	b	SE	p
Height	0.48	0.08	0.000
BMI	0.79	0.22	0.000
Hip circumference	- 0.29	0.12	0.015
Constant	- 36.98		

R^2=0,19
Source: primary data

The bivariate analysis found a significant positive correlation of BMI, height, weight, waist circumference, and hip circumference with handgrip strength (p=0.006, r=0.20; p=<0.001, r=0.36; p=<0.001, r=0.32; p=0.009, r=0.19; p=0.005; r=0.20, respectively). This showed that the larger the BMI, height, weight, waist circumference, and hip circumference, the stronger the handgrip. However, there was no significant relationship between fasting glucose concentration and handgrip strength (p=0.847). This study also found that age had a significant negative correlation with handgrip strength (p=0.011; r=-0.182), signifying that the older a person, the lower the handgrip strength (Table 3). Results of multiple regression analysis on handgrip strength are listed in Table 4.

This study found that most of the public works personnel in Duri Kosambi village were Muslims, had a senior high school level of education, and were of Betawi ethnicity. This was in line with the demographic data in the Cengkareng district, in that Duri Kosambi was the village with the greatest area, most of the residents were male, and the Islamic religion had the most believers (Badan Pusat Statistik Jakarta Barat, 2020). Among our respondents, more than ten percent were in the diabetes category. Socio-demographic factors capable of affecting dietary habits in patients with diabetes are the level of education and the type of family (Rondhianto *et al*., 2024). Among the respondents of this study, the dominant right hand was used for working. In the adult population, a total of 90% of the residents preferred to use the right hand for manual tasks, whereas around 10% used the left hand (Zaccagni *et al*., 2020). According to Agtuahene *et al.* (Agtuahene *et al*., 2023), the dominant hand is generally around 10% stronger than the non-dominant hand. Many activities in daily life need a high level of exertion of the muscles of the hand and forearm (Hammed *et al*., 2017). The frequent use of the dominant hand in daily living results in the muscles of the hand and forearm providing strength in gripping (Afaq *et*

al., 2019).

The mean handgrip strength in this study was 33.1 ± 6.9 kg, which is relatively low if compared with the study results of Kurniawan *et al*. (Kurniawan *et al*., 2018). In healthy young Indonesian adults, the mean handgrip strength in males was 37.37 ± 8.29 kg, and the lower limit of muscle strength in Indonesian males was 20.79 kg. The handgrip strength results in both studies are still below those of males in other Southeast Asian countries, according to the study results of Leong *et al*. (Leong *et al*., 2016). These investigators found that the mean handgrip strength in Southeast Asian males aged 35-40 years was 40 kg (34-44 kg); for the age range of 41-50 years, the handgrip strength was 38 kg (33-44 kg), for the age range of 51-60 years it was 34 kg (30-40 kg), and for ages 61-70 years 30 kg (24-34 kg). This may have been caused by ethnic differences mediated by genetic differences that also affect individual muscle strength. The highest handgrip strength is found in the European and North American populations, whereas the lowest handgrip strength is found in African, South Asian, and Southeast Asian populations. These variations in muscle strength in various countries may also be partly caused by differences in socio-economic status (Leong *et al*., 2016).

According to Agtuahene *et al*. (Agtuahene *et al*., 2023), handgrip strength is a physiological variable influenced by several factors, such as age, sex, and body measurements. In contrast, according to Zaccagni *et al*. (Zaccagni *et al*., 2020), handgrip strength, apart from being affected by age, may also be influenced by physical activity, grip measurement, height, and body mass. The present study found a significant positive correlation between BMI and handgrip strength. According to Hammed *et al*., this may be caused by the higher percentage of skeletal muscle mass compared to the percentage of fat mass, thereby resulting in a higher handgrip strength [13]. Our study's results are identical to those of Agtuahene *et al*. (Agtuahene *et al*., 2023), who found a significant positive correlation (r=0.290) of handgrip strength with BMI and height. This shows that taller individuals with higher BMI apparently have greater handgrip strength. Our study is also in line with the study of Krakauer in 2020, which showed a positive correlation between BMI and handgrip strength (Krakauer *et al*., 2020).

The study of Cooper *et al*. (Cooper *et al*., 2022) concluded that a high childhood BMI is associated with higher grip strength at age 46 years. This is because fat mass acts as a mechanical load that elicits an anabolic response that stimulates muscle growth and function. This anabolic response is usually greater in males than in females because of the higher testosterone concentration. However, it should also be noted that BMI does not differentiate between fat mass and lean mass as adipocyte indicators that may vary with sex. It should be noted that BMI is a measure of body fat that does not differentiate between weight changes because of an increase or decrease in muscle mass or body fat (Zaccagni *et al*., 2020). According to Jafar *et al*. (Jaafar *et al*., 2023), heavier individuals have a greater muscle mass, resulting in greater handgrip strength, than lighter individuals. In the study of Heidy *et al*. (Heidy *et al*., 2019), the investigators found a positive correlation between height and forearm length. The study by Sirajudeen *et al*. (Sirajudeen *et al*., 2012) found a positive correlation between hand length and handgrip strength. This shows that height affects the longer extremity or arm, thus approaching optimal muscle length that may result in greater grip strength. According to a prospective cohort study, handgrip strength in middle age appears to be associated with birth weight and the increase in height at puberty. Pubertal growth and handgrip strength possibly represent the development of muscle size and growth (Schrager *et al*., 2007).

Our study found no relationship between blood glucose concentration and handgrip strength. Our study agrees with the study of Giglio *et al*. (Giglio *et al*., 2018), which showed no significant relationship between muscle mass strength and blood glucose concentration. According to Giglio, this is because most respondents are individuals who routinely perform structured physical activity, even though they are in the light category. This is similar to our study respondents, who were public works personnel and who had performed physical activity such as street sweeping and cleaning storm drains. Glucose is the main fuel

for muscle contraction, entering the muscle cells by diffusion through the GLUT4 glucose transporter, which, after muscle contraction, moves from its intracellular storage site to the plasma membrane and T-tubules (Richter *et al*., 2013). Glucose metabolism has an influence on handgrip strength through various mechanisms, such as disorders of glucose metabolism, particularly glycogenolysis, that may result in the loss of muscle strength. Insulin resistance in hyperglycemia may cause muscle degradation because hyperglycemia causes low muscle strength through effects on skeletal muscle mitochondria. The lowering of muscle strength by hyperglycemia occurs through Krüppel-like factor 15, which regulates skeletal muscle lipid flux. Hyperglycemia also increases pro-inflammatory cytokines, which may increase the catabolism that plays a role in the further decrease in muscle mass and quality (Gamayanti *et al*., 2023). The amount of carbohydrates also influences the glycemic response and post-prandial insulin level, impacting the supply of glycogen to the muscles (Safitri *et al*.,2020).

This study has a significant negative correlation between age and handgrip strength, which decreases with age (Manoharan *et al*., 2015). Handgrip strength initially experiences an increase with increasing age, reaches its peak between the ages of 30 and 40 years, and decreases afterward (Zaccagni *et al*., 2020). The age-related changes in skeletal muscle composition, particularly the accumulation of lipids in skeletal muscle fibers, play a role in the poor quality of the muscles and may result in metabolic abnormalities such as insulin resistance. Apart from changes in muscle quality, there is also a reduction in muscle mass that consistently occurs during aging. The increase in oxidative stress and chronic inflammation that commonly occurs in the aging process apparently also plays a role in the development of decreased muscle mass and strength (Mainous *et al*., 2015). The decrease in muscle mass in the elderly corresponds to a 10% reduction in grip strength per decade, starting from the age of 40 years (Jaafar *et al*., 2023). Skeletal muscle plays an important role in glucose metabolism and has a significant influence on insulin sensitivity. Increased insulin resistance in older adults may be closely associated with skeletal muscle aging. A reduction in GLUT4 expression as a result of a decrease in muscle volume causes a reduction in insulin sensitivity in aging skeletal muscle (Joo *et al*., 2022). The results of this study showed a correlation of waist circumference and hip circumference with handgrip strength. This is in line with the study of Widjaja *et al*. (Widjaja *et al*., 2018), who stated that there was a significant correlation of waist circumference and hip circumference with handgrip strength ($p=<0.001$, $r=0.302$; and $p=<0.001$, $r=0.296$) A greater waist circumference is associated with a greater handgrip strength in males (Hardy *et al*., 2013).

In the multiple regression analysis of HGS, we removed the data on body weight because of the occurrence of multicollinearity between weight and BMI, with a correlation coefficient of more than 0.9, indicating an extremely strong relationship between these two variables. Conceptually, only one of the variables is used in multivariate analysis. The multiple regression analysis included age, height, BMI, waist circumference, and hip circumference, with HGS as the dependent variable in a stepwise manner. After three iterations, only height, BMI, and hip circumference played a role in predicting HGS by means of the regression formula, which resulted in $R^2=0.19$. This signifies that for known values of height, BMI, and hip circumference, we can predict the HGS value 19% more accurately than without knowledge of these data. For a clinical diagnosis, a minimum increase of 10% is needed. This study found that height, BMI, and hip circumference play a role in predicting handgrip strength through the regression formula, i.e., handgrip strength = - 36.98 + 0.48 x height + 0.79 x BMI – 0.29 x hip circumference. Handgrip strength and waist circumference are surrogate muscle strength and visceral adiposity markers, respectively (Nakanishi *et al*., 2024). Waist circumference is also more sensitive in determining body fat distribution, particularly in the abdomen. Waist circumference correlates better with abdominal fat distribution than BMI (Rondhianto *et al*., 2024). Waist circumference and hip circumference are associated with obesity, in which the fat content is higher, and

the skeletal muscle and fascicular content is lower, thereby resulting in a lower contractile capacity of skeletal muscle (Afaq *et al*., 2019). The limitation of this study is that it did not evaluate other factors that may affect handgrip strength, such as nutrient intake. From the anthropometric measures of the hands and feet in this study, the causes and effects of the decrease in handgrip strength could not be determined because this study used a cross-sectional design.

Conclusion

Three factors may be used to estimate handgrip strength in PWP, namely height, BMI, and hip circumference, whereas blood glucose concentration is not correlated with handgrip strength in PWP. It is recommended to pay attention to height, BMI, and hip circumference, particularly in the acceptance criteria of PWP candidates, and to conduct further studies with consideration of other factors that affect handgrip strength, such as food intake and anthropometric features of the hands and arms.

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References

Afaq, E., Hassan, S.H., Khan, M.R., Zaidi, D.A., & Baktashi, H., 2019. Correlation of Hand Dynamometry With Body Mass Index and Waist-Hip Ratio in Medical Students. *Pak J Physiol*.,15, pp.19-21.

Agtuahene, M.A., Quartey, J., & Kwakye, S., 2023. Influence of Hand Dominance, Gender, and Body Mass Index on Hand Grip Strength. *S Afr J Physiother.*, 79, pp.1-6.

Al-Asadi, J.N., 2018. Handgrip Strength in Medical Students: Correlation with Body Mass Index and Hand Dimensions. *Asian Journal of Medical Sciences*, 9, pp.21-26.

Badan Pusat Statistik Kota Administrasi Jakarta Barat., 2020. *Kecamatan Cengkareng Dalam Angka*, pp.1-114.

Chen, D., Zhu, Y., Ni, W., Li, Y., Yin, G., Shao, Z., & Zhu, J., 2023. Hand Grip Strength is Inversely Associated with Total Daily Insulin Dose Requirement in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study. *PeerJ*., pp.1-13.

Cooper, R., Tomlinson, D., Hamer, M., & Pereira, S.M.P., 2022. Lifetime Body Mass Index and Grip Strength at Age 46 Years: The 1970 British Cohort Study. *J Cachexia Sarcopenia Muscle*, 13, pp.1-10.

Fauzi, L., Handayani, O.W.K., Susilo, M.T., Kurnia, A.R., Rahayu, S.R., Irawan, F.A., Horng Lu, F.J., Lin, C., Lai, M.F., & Yu, Y.C., 2022. Obesity in Indonesian and Taiwanese Adolescents Related to Self Perception, Diet, Exercise, and Body Image. *KEMAS*, 17(3), pp.453-461.

Gamayanti, K.A.V., Aryana, I.G.P.S., & Gotera, W., 2023. Hubungan Antara Kekuatan Genggaman Tangan Dengan Kadar Gula Darah Sewaktu Pada Lansia Di Desa Melinggih, Kecamatan Payangan, Kabupaten Gianyar. *Intisari Sains Medis*, 14(2), pp.483-488.

Giglio, B.M., Mota, J.F., Wall, B.T., & Pimentel, G.D., 2018. Low Handgrip Strength is Not Associated With Type 2 Diabetes Mellitus and Hyperglycemia: A Population-Based Study. *Clin Nutr Res*., 7(2), pp.112-116.

Hammed, A.I., & Obaseki, C.O., 2017. Interdependence of Body Mass Index with Handgrip Strength and Endurance Among Apparently Healthy Teenagers. *Turk J Kin*., 4, pp.1-7.

Handayani, M.D.N., Sadewa, A.H., Farmawati, A., & Rochmah, W., 2018. Anthropometric Prediction Equations for Estimating Muscle Mass of Elderly Women. *KEMAS*, 14(2),pp.195-204.

Hardy, R., Cooper, R., Sayer, A.A., Shlomo, Y.B., Cooper, C., Deary, I.J., Demakakos, P., Gallacher, J., Martin, R.M., McNeill, G., Starr, J.M., Steptoe, A., Syddall, H., & Kuh, D., 2013. Body Mass Index, Muscle Strength, and Physical Performance in Older Adults From Eight Cohort Studies: The Halcyon Programme. *PLoS One*, 8(2), pp.e56483.

Heidy., Djuartina, T., & Irawan, R., 2019. Korelasi Kekuatan Genggaman Tangan Dengan Karakter Antropometri Lengan Bawah dan Tangan Serta Indeks Massa Tubuh. *Damianus Journal of Medicine*,18, pp.1-7.

Ilmi, A.F., & Utari, D.M., 2020. Hubungan Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul (RLPP) Terhadap Kadar Glukosa Darah Puasa Pada Mahasiswa. *Journal of Nutrition College*, 9, pp.222-227.

Jaafar, M.H., Ismail, R., Ismail, N.H., Isa, Z.M., Tamil, A.M., Nasir, N.M., Keat, N.K., Razak, N.H., Abidin, N.Z., & Yusof, K.H., 2023. Normative Reference Values and Predicting Factors of Handgrip Strength For Dominant

and Non-Dominant Hands Among Healthy Malay Adults in Malaysia. *BMC Musculoskelet Disord*., 24, pp.1-9.

Joo, K.C., Son, D.H., & Park, J.M., 2022. Association Between Relative Handgrip Strength and Insulin Resistance in Korean Elderly Men Without Diabetes: Findings Of The 2015 Korea National Health Nutrition Examination Survey. *Korean J Fam Med*., 43, pp.199-205.

Krakauer, N.Y., & Krakauer, J.C., 2020. Association of Body Shape Index (ABSI) with Hand Grip Strength. *Int J Environ Res Public Health*,17, pp.1-12.

Kurniawan, A., Widjaja, D., & Lugito, N.P.H., 2018. *Mean and Cutoff Value of Hand Grip Strength For Healthy Indonesian Young Adults*. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.

Leong, D.P., Teo, K.K., Rangarajan, S., Kutty, R., Lanas, F., Hui, C., Quanyong, X., Zhenzhen, Q., Jinhua, T., Noorhassim, I., AlHabib, K.F., Moss, S.J., Rosengren, A., Akalin, A.A., Rahman, O., Chifamba, J., Orlandini, A., Kumar, R., Yeates, K., Gupta, R., Yusufali, A., Dans, A., Avezum, A., Lopez-Jaramillo, P., Poirier, P., Heidari, H., Zatonska, K., Iqbal, R., Khatib, R., & Yusuf, S., 2016. Reference Ranges of Handgrip Strength From 125,462 Healthy Adults in 21 Countries: A Prospective Urban Rural Epidemiologic (PURE) Study. *J Cachexia Sarcopenia Muscle*,7, pp.535-546.

Mainous, A.G., Tanner, R.J., Anton, S.D., & Jo, A., 2015. Grip Strength as A Marker of Hypertension and Diabetes in Healthy Weight Adults. *Am J Prev Med*, 49(6), pp.850-858.

Manoharan, V.S., Sundaram, S.G., & Jason, J.I., 2015. Factors Affecting Hand Grip Strength and Its Evaluation: A Systemic Review. *Int J Physiother Res*., 3(6), pp.1288-1293.

McGrath, R., Johnson, N., Klawitter, L., Mahoney, S., Trautman, K., Carlson, C., Rockstad, E., & Hackney, K.J., 2020. What Are The Association Patterns Between Handgrip Strength and Adverse Health Conditions? A Topical Review. *SAGE Open Medicine*, 8, pp.1-12.

Nakanishi, S., Shimoda, M., Kimura, T., Sanada, J., Fushimi, Y., Iwamoto, Y., Iwamoto, H., Dan, K., Mune, T., Kaku, K., & Kaneto, H., 2024. The Impact of Handgrip Strength and Waist Circumference on Glycemic Control: Prospective, Observational Study Using Outpatient Clinical Data in Japanese Patients With Type 2 Diabetes Mellitus. *J Diabetes Investig*., 15(7), pp.892-898.

Nathania, N.P.S., Nugraha, M.H.S., Primayanti, I.D.A., & Saraswati, P.A.S., 2023. Handgrip Strength is Associated With Balance in Elderly Women. *Majalah Ilmiah Fisioterapi Indonesia*, 11, pp.70-75.

Gubernur Provinsi Daerah Khusus Ibukota Jakarta., 2017. *Peraturan Gubernur Provinsi Daerah Khusus Ibukota Jakarta Nomor 7 tahun 2017 Tentang Penanganan Prasarana dan Sarana Umum Tingkat Kelurahan*. Jakarta 2017.

Richter, E.A., & Hargreaves, M., 2013. Exercise, GLUT4, and Skeletal Muscle Glucose Uptake. *Physiol Rev*., 93(3), pp.993-1017.

Rondhianto., Ridla, A.Z., & Hasan, H., 2024. Sociodemographic Factors Affecting Diabetic Dietary Behavior in People with Type 2 Diabetes Mellitus. *KEMAS*, 19(3), pp.429-437.

Safitri, I., Setyarsih, L., Susanto, H., Suhartono., & Fitranti, D.Y., 2020. The Effect of Low and High Glycemic Load Diet on Muscle Fatigue of Young Soccer Athletes. *KEMAS*, 16(1), pp.111-120.

Schrager, M.A., Metter, E.J., Simonsick, E., Ble, A., Bandinelli, S., Lauretani, F., & Ferrucci, L., 2007. Sarcopenic Obesity and Inflammation in The Inchianti Study. *J Appl Physiol*., 102(3), pp.919-925.

Sirajudeen, M.S., Shah, U.N., Pillai, P.S., Mohasin, N., & Shantaram, M., 2012. Correlation Between Grip Strength and Physical Factors in Men. *International Journal of Health and Rehabilitation Sciences*, 1, pp.58-63.

Soenyoto, T., Mollap, K., & Mungpong, J., 2017. Correlation of Energy and Protein Consumption Levels with Physical Endurance of Rhythmic Gymnast Athletes. *KEMAS*, 13(1), pp.131-136.

Soraya, N., & Parwanto, E., 2023. The Controversial Relationship Between Body Mass Index and Handgrip Strength in The Elderly: An Overview. *Malays J Med Sci*., 30, pp.73-83.

Vaishya, R., Misra, A., Vaish, A., Ursino, N., & D'Ambrosi, R., 2024. Hand Grip Strength as A Proposed New Vital Sign Of Health: A Narrative Review of Evidences. *Journal of Health, Population and Nutrition*, 43, pp.1-14.

Widjaja, D., Tjhai, K., Dermawan, K., Kalim, J., Tanzil, S., Pramusinta, A., Phenca, H.K., Kurniawan, A., 2018. *Correlations Between Hand Grip Strength and Anthropometric Status in Young Indonesian Adults*. World

Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.

Zaccagni, L., Toselli, S., Bramanti, B., Gualdi-Russo, E., Mongillo, J., & Rinaldo, N., 2020. Handgrip Strength in Young Adults: Association With Anthropometric Variables and Laterality. *Int J Environ Res Public Health*, 17, pp.1-18.

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Handgrip Strength of Public Works Personnel in West Jakarta

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Abstract

Public Works Personnel (PWP) in Jakarta perform their routine duties manually instead of using equipment. Handgrip strength (HGS) measures maximum hand strength as a quality indicator for muscle strength and mass. Factors affecting muscle strength are age, sex, body mass index (BMI), waist circumference (WC), and hip circumference (HC). Increased fasting blood glucose (FBG) is also associated with muscle quality, muscle strength, and physical performance. This study aimed to determine the factors associated with handgrip strength in PWP. A total of 192 male PWP from the Cengkareng district were recruited by simple random sampling. The collected data were demographics, BMI, FBG, WC, HC, and HGS. Statistical analysis was done using Pearson's correlation test and multiple regression analysis. There was a significant positive correlation of BMI, WC, and HC with HGS (p=0.006; r=0.20, p=0.009; r=0.19, and p=0.005; r=0.20) and a significant negative correlation between age and HGS (p=0.008; r=-0.19) but not between FBG and HGS (p=0.847). Multiple regression analysis showed height, BMI, and HC positively predicting HGS (R2=0.19). Handgrip strength of public works personnel is associated with BMI, age, waist circumference, and hip circumference, but not with fasting blood glucose. Height, BMI, and hip circumference predict handgrip strength

Introduction

Personnel for the management of public infrastructure and facilities at the village level are workers who manage village public works for a given time period on the basis of a work order. The tasks of village-level public works personnel (PWP) consist of managing the infrastructure and facilities, such as streets, drains, and parks, including installed lights (Gubernur Provinsi Daerah Khusus Ibukota Jakarta, 2017). The work performed by village PWP consists mainly of intense physical activity involving the hands, such that handgrip strength is essential in their tasks. Lowering of handgrip strength may indicate reduced muscle strength, which may especially interfere with the daily activities of village PWP that consist mainly of manual labor.

Handgrip strength measures maximal hand strength and indicates muscle quality that reflects muscle strength and mass. Muscle strength refers to the ability of muscle groups to raise a given load. Low or poor grip strength is frequently associated with damaging health impacts, such as chronic disease, and is the initial sign of reduced muscle mass, limitations in physical functions, and mortality risk. Poor handgrip strength may also reduce a person's ability to perform activities of daily living and, therefore, impact quality of life (Soraya *et al*., 2023; Nathania *et al*., 2023). Muscle mass accounts for approximately 40% of total weight, such that knowledge of muscle mass conditions is essential in maintaining health and activities (Handayani *et al*., 2018).

Handgrip strength may represent the strength of all muscles in the body. Several factors possibly influencing an individual's muscle strength are age, sex, and body mass index (BMI) (Soraya *et al*., 2023). Obesity may also affect BMI. Obesity in adults is not only associated with genetic factors but also with

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environmental factors during development (Fauzi *et al*., 2022). Handgrip strength is also associated with chronic diseases such as diabetes, metabolic syndrome, and cardiovascular disease. Increased glucose concentration is also associated with disorders of muscle quality and strength, as well as physical performance (Chen *et al*., 2023). A reduction in muscle mass also affects an individual's strength and physical endurance. A combination of proteins can maintain muscle function, thereby building body strength and physical endurance (Soenyoto *et al*., 2017). In the present study, we included fasting blood glucose concentrations in the data collection to obtain more accurate measures of glucose concentrations that have not yet been influenced by food intake.

Handgrip strength may be a health indicator that provides information on a person's health (Vaishya *et al*., 2024). However, its clinical significance in determining the prevention and treatment of poor handgrip remains limited because of the still unclear etiology of muscle weakness, especially because the clinical outcomes associated with handgrip strength are extremely diverse (McGrath *et al*., 2020). The relationship between BMI and handgrip strength is still controversial, with several investigators finding a significant positive association and others reporting a non-significant relationship (Al Asadi, 2018). There are few studies on handgrip strength, especially on workers in the sanitation sector, such as public works personnel, which is why the present investigators were interested in studying this topic. The present study aimed to determine the factors associated with handgrip strength in public works personnel.

Method

This cross-sectional study involving male public works personnel in Cengkareng District, West Jakarta, was conducted from September to October 2024. The study sample was selected by simple random sampling. Calculation of the sample size for a correlation with r=0.2, Zα=0.05, and Zβ=0.1 resulted in a sample of 192 subjects who met the inclusion criterion of being male and 25-60 years old, and the exclusion criteria of having an abnormality of the hands, heart disease, pulmonary disease, and malignancies.

Measurements were obtained on height in cm, weight in kg, as well as waist circumference and hip circumference in cm. Height and weight were determined using microtoise and digital scales, respectively. BMI was calculated using the formula of weight divided by height squared. Measurement of waist and hip circumferences was done using a measuring tape. Waist circumference was determined with the subject in the upright position, at the end of a normal expiration, at the smallest abdominal circumference between the iliac crest and twelfth rib. The cut-off values for waist circumference in males and females are ≥ 90 cm and ≥ 80 cm, respectively. Hip circumference was measured using a measuring tape that was applied around the hips at the level of the symphysis pubis and the maximal gluteal circumference (Rokhmah *et al*., 2015).

Fasting blood glucose (FBG) concentration was determined on venous blood by the hexokinase method after the respondents had fasted for approximately 10 hours prior. Handgrip strength was measured with a handgrip strength dynamometer to the nearest kilogram as follows: The respondent was asked to sit down comfortably without reclining and with the feet completely relaxed. The hips and knees were positioned at a 90^0 angle, the gripping hand with the shoulder in adduction, the elbow flexed 90^0, and the forearm and wrist in the neutral position. The gripping duration was 3 seconds. The respondent gripped the instrument with the dominant hand as hard as possible, and the value indicated by the needle was recorded. In accordance with the protocol recommended by the American Society of Hand Therapists (ASHT), the recorded handgrip strength was the average of three handgrip strength tests (Nathania *et al*., 2023).

Before data analysis by means of the correlation test, the normality of the data distribution was determined using the Kolmogorov-Smirnov test. The Pearson correlation test was used for a normal data distribution, whereas for a non-normal data distribution, the Spearman correlation test was done, followed by a multiple regression analysis. Ethics approval was issued by the Ethics Committee of the Faculty of Medicine,

Universitas Trisakti, under No. 033/KER/FK/08/2024.

Result and Discussion

In this study, the respondents comprised 192 male public works personnel of Cengkareng District who consisted of the villages (subdistricts) of Kedaung, Duri Kosambi, West Cengkareng, Kapuk, and Rawa Buaya. A total of 26% of the respondents were residents of Duri Kosambi, where Muslims comprised 98.4% of the population. The majority of the respondents, at 77.6% had an educational level of senior high school. Nearly all of the respondents, or 99%, were right-handed, using the right hand as the dominant one at work, and most were of the Betawi (Jakarta) ethnic group at 51.6% (Table 1).

Table 1. Demographic Data of the Respondents

Characteristic	**N (%)**
Village	
Kedaung	40 (20.8)
Duri Kosambi	50 (26)
Cengkareng Barat	33 (17.2)
Kapuk	43 (22.4)
Rawa Buaya	26 (13.5)
Religion	
Islamic	189 (98.4)
Christian	2 (1)
Catholic	1 (0.5)
Level of education	
Elementary school	7 (3.6)
Junior high school	29 (15.1)
Senior high school	149 (77.6)
Academy-University	7 (3.6)
Dominant hand	
Right hand	190 (99)
Left hand	2 (1)
Ethnic group	
Javanese	53 (27.6)
Betawi	99 (51.6)
Sundanese	25 (13)
Other	14 (7.3)

Legend: Other ethnicities comprised groups from Palembang, Lampung, Bima, and Kupang
Source: primary data 2024 (questionnaires and interviews with respondents)

Table 2. Respondents' Characteristics

Variable	**Mean ± SD**
Age (years)	40.9 ± 8.9
Height (cm)	164.6 ± 6.7
Weight (kg)	64.7 ± 13.1
BMI (kg/m^2)	23.8 ± 4.3
Waist circumference (cm)	85.4 ± 10.4
Hip circumference (cm)	96.9 ± 8.4

HGS (kg)	33.1 ± 6.9
FBG (mg/dL)	87 (64-280)*

Legend: BMI: body mass index. *FBG: fasting blood glucose, expressed as Median (Min-Max).
HGS: handgrip strength
Source: primary data (respondents' measurements)

Table 3. Analysis of the Relationship of Age, Height, Weight, BMI, Waist Circumference, Hip Circumference, and Fasting Blood Glucose Concentration with Handgrip Strength

Variable	R	P value
Age	- 0.19	0.008*
Height	0.36	0.000*
Weight	0.32	0.000*
BMI	0.20	0.006*
Waist circumference	0.19	0.009*
Hip circumference	0.20	0.005*
FBG	0.02	0.847#

*P value with Pearson's test, # Spearman's test
Source: primary data

Table 4. Multiple Regression Analysis on Handgrip Strength

Determinant	b	SE	p
Height	0.48	0.08	0.000
BMI	0.79	0.22	0.000
Hip circumference	- 0.29	0.12	0.015
Constant	- 36.98		

R^2=0,19
Source: primary data

The bivariate analysis found a significant positive correlation of BMI, height, weight, waist circumference, and hip circumference with handgrip strength (p=0.006, r=0.20; p=<0.001, r=0.36; p=<0.001, r=0.32; p=0.009, r=0.19; p=0.005; r=0.20, respectively). This showed that the larger the BMI, height, weight, waist circumference, and hip circumference, the stronger the handgrip. However, there was no significant relationship between fasting glucose concentration and handgrip strength (p=0.847). This study also found that age had a significant negative correlation with handgrip strength (p=0.011; r=-0.182), signifying that the older a person, the lower the handgrip strength (Table 3). Results of multiple regression analysis on handgrip strength are listed in Table 4.

This study found that most of the public works personnel in Duri Kosambi village were Muslims, had a senior high school level of education, and were of Betawi ethnicity. This was in line with the demographic data in the Cengkareng district, in that Duri Kosambi was the village with the greatest area, most of the residents were male, and the Islamic religion had the most believers (Badan Pusat Statistik Jakarta Barat, 2020). Among our respondents, more than ten percent were in the diabetes category. Socio-demographic factors capable of affecting dietary habits in patients with diabetes are the level of education and the type of family (Rondhianto *et al*., 2024). Among the respondents of this study, the dominant right hand was used for working. In the adult population, a total of 90% of the residents preferred to use the right hand for manual tasks, whereas around 10% used the left hand (Zaccagni *et al*., 2020). According to Agtuahene *et al.* (Agtuahene *et al*., 2023), the dominant hand is generally around 10% stronger than the non-dominant hand. Many activities in daily life need a high level of exertion of the muscles of the hand and forearm (Hammed *et al*., 2017). The frequent use of the dominant hand in daily living results in the muscles of the hand and forearm providing strength in gripping (Afaq *et*

al., 2019).

The mean handgrip strength in this study was 33.1 ± 6.9 kg, which is relatively low if compared with the study results of Kurniawan *et al*. (Kurniawan *et al*., 2018). In healthy young Indonesian adults, the mean handgrip strength in males was 37.37 ± 8.29 kg, and the lower limit of muscle strength in Indonesian males was 20.79 kg. The handgrip strength results in both studies are still below those of males in other Southeast Asian countries, according to the study results of Leong *et al*. (Leong *et al*., 2016). These investigators found that the mean handgrip strength in Southeast Asian males aged 35-40 years was 40 kg (34-44 kg); for the age range of 41-50 years, the handgrip strength was 38 kg (33-44 kg), for the age range of 51-60 years it was 34 kg (30-40 kg), and for ages 61-70 years 30 kg (24-34 kg). This may have been caused by ethnic differences mediated by genetic differences that also affect individual muscle strength. The highest handgrip strength is found in the European and North American populations, whereas the lowest handgrip strength is found in African, South Asian, and Southeast Asian populations. These variations in muscle strength in various countries may also be partly caused by differences in socio-economic status (Leong *et al*., 2016).

According to Agtuahene *et al*. (Agtuahene *et al*., 2023), handgrip strength is a physiological variable influenced by several factors, such as age, sex, and body measurements. In contrast, according to Zaccagni *et al*. (Zaccagni *et al*., 2020), handgrip strength, apart from being affected by age, may also be influenced by physical activity, grip measurement, height, and body mass. The present study found a significant positive correlation between BMI and handgrip strength. According to Hammed *et al*., this may be caused by the higher percentage of skeletal muscle mass compared to the percentage of fat mass, thereby resulting in a higher handgrip strength. Our study's results are identical to those of Agtuahene *et al*. (Agtuahene *et al*., 2023), who found a significant positive correlation (r=0.290) of handgrip strength with BMI and height. This shows that taller individuals with higher BMI apparently have greater handgrip strength. Our study is also in line with the study of Krakauer in 2020, which showed a positive correlation between BMI and handgrip strength (Krakauer *et al*., 2020).

The study of Cooper *et al*. (Cooper *et al*., 2022) concluded that a high childhood BMI is associated with higher grip strength at age 46 years. This is because fat mass acts as a mechanical load that elicits an anabolic response that stimulates muscle growth and function. This anabolic response is usually greater in males than in females because of the higher testosterone concentration. However, it should also be noted that BMI does not differentiate between fat mass and lean mass as adipocyte indicators that may vary with sex. It should be noted that BMI is a measure of body fat that does not differentiate between weight changes because of an increase or decrease in muscle mass or body fat (Zaccagni *et al*., 2020). According to Jafar *et al*. (Jaafar *et al*., 2023), heavier individuals have a greater muscle mass, resulting in greater handgrip strength, than lighter individuals. In the study of Heidy *et al*. (Heidy *et al*., 2019), the investigators found a positive correlation between height and forearm length. The study by Sirajudeen *et al*. (Sirajudeen *et al*., 2012) found a positive correlation between hand length and handgrip strength. This shows that height affects the longer extremity or arm, thus approaching optimal muscle length that may result in greater grip strength. According to a prospective cohort study, handgrip strength in middle age appears to be associated with birth weight and the increase in height at puberty. Pubertal growth and handgrip strength possibly represent the development of muscle size and growth (Schrager *et al*., 2007).

Our study found no relationship between blood glucose concentration and handgrip strength. Our study agrees with the study of Giglio *et al*. (Giglio *et al*., 2018), which showed no significant relationship between muscle mass strength and blood glucose concentration. According to Giglio, this is because most respondents are individuals who routinely perform structured physical activity, even though they are in the light category. This is similar to our study respondents, who were public works personnel and who had performed physical activity such as street sweeping and cleaning storm drains. Glucose is the main fuel

for muscle contraction, entering the muscle cells by diffusion through the GLUT4 glucose transporter, which, after muscle contraction, moves from its intracellular storage site to the plasma membrane and T-tubules (Richter *et al*., 2013). Glucose metabolism has an influence on handgrip strength through various mechanisms, such as disorders of glucose metabolism, particularly glycogenolysis, that may result in the loss of muscle strength. Insulin resistance in hyperglycemia may cause muscle degradation because hyperglycemia causes low muscle strength through effects on skeletal muscle mitochondria. The lowering of muscle strength by hyperglycemia occurs through Krüppel-like factor 15, which regulates skeletal muscle lipid flux. Hyperglycemia also increases pro-inflammatory cytokines, which may increase the catabolism that plays a role in the further decrease in muscle mass and quality (Gamayanti *et al*., 2023). The amount of carbohydrates also influences the glycemic response and post-prandial insulin level, impacting the supply of glycogen to the muscles (Safitri *et al*.,2020).

This study has a significant negative correlation between age and handgrip strength, which decreases with age (Manoharan *et al*., 2015). Handgrip strength initially experiences an increase with increasing age, reaches its peak between the ages of 30 and 40 years, and decreases afterward (Zaccagni *et al*., 2020). The age-related changes in skeletal muscle composition, particularly the accumulation of lipids in skeletal muscle fibers, play a role in the poor quality of the muscles and may result in metabolic abnormalities such as insulin resistance. Apart from changes in muscle quality, there is also a reduction in muscle mass that consistently occurs during aging. The increase in oxidative stress and chronic inflammation that commonly occurs in the aging process apparently also plays a role in the development of decreased muscle mass and strength (Mainous *et al*., 2015). The decrease in muscle mass in the elderly corresponds to a 10% reduction in grip strength per decade, starting from the age of 40 years (Jaafar *et al*., 2023). Skeletal muscle plays an important role in glucose metabolism and has a significant influence on insulin sensitivity. Increased insulin resistance in older adults may be closely associated with skeletal muscle aging. A reduction in GLUT4 expression as a result of a decrease in muscle volume causes a reduction in insulin sensitivity in aging skeletal muscle (Joo *et al*., 2022). The results of this study showed a correlation of waist circumference and hip circumference with handgrip strength. This is in line with the study of Widjaja *et al*. (Widjaja *et al*., 2018), who stated that there was a significant correlation of waist circumference and hip circumference with handgrip strength ($p=<0.001$, $r=0.302$; and $p=<0.001$, $r=0.296$) A greater waist circumference is associated with a greater handgrip strength in males (Hardy *et al*., 2013).

In the multiple regression analysis of HGS, we removed the data on body weight because of the occurrence of multicollinearity between weight and BMI, with a correlation coefficient of more than 0.9, indicating an extremely strong relationship between these two variables. Conceptually, only one of the variables is used in multivariate analysis. The multiple regression analysis included age, height, BMI, waist circumference, and hip circumference, with HGS as the dependent variable in a stepwise manner. After three iterations, only height, BMI, and hip circumference played a role in predicting HGS by means of the regression formula, which resulted in $R^2=0.19$. This signifies that for known values of height, BMI, and hip circumference, we can predict the HGS value 19% more accurately than without knowledge of these data. For a clinical diagnosis, a minimum increase of 10% is needed. This study found that height, BMI, and hip circumference play a role in predicting handgrip strength through the regression formula, i.e., handgrip strength = - 36.98 + 0.48 x height + 0.79 x BMI – 0.29 x hip circumference. Handgrip strength and waist circumference are surrogate muscle strength and visceral adiposity markers, respectively (Nakanishi *et al*., 2024). Waist circumference is also more sensitive in determining body fat distribution, particularly in the abdomen. Waist circumference correlates better with abdominal fat distribution than BMI (Rokhmah *et al*., 2015). Waist circumference and hip circumference are associated with obesity, in which the fat

content is higher, and the skeletal muscle and fascicular content is lower, thereby resulting in a lower contractile capacity of skeletal muscle (Afaq *et al*., 2019). The limitation of this study is that it did not evaluate other factors that may affect handgrip strength, such as nutrient intake. From the anthropometric measures of the hands and feet in this study, the causes and effects of the decrease in handgrip strength could not be determined because this study used a cross-sectional design.

Conclusion

Three factors may be used to estimate handgrip strength in PWP, namely height, BMI, and hip circumference, whereas blood glucose concentration is not correlated with handgrip strength in PWP. It is recommended to pay attention to height, BMI, and hip circumference, particularly in the acceptance criteria of PWP candidates, and to conduct further studies with consideration of other factors that affect handgrip strength, such as food intake and anthropometric features of the hands and arms.

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References

Afaq, E., Hassan, S.H., Khan, M.R., Zaidi, D.A., & Baktashi, H., 2019. Correlation of Hand Dynamometry With Body Mass Index and Waist-Hip Ratio in Medical Students. *Pak J Physiol*.,15, pp.19-21.

Agtuahene, M.A., Quartey, J., & Kwakye, S., 2023. Influence of Hand Dominance, Gender, and Body Mass Index on Hand Grip Strength. *S Afr J Physiother.*, 79, pp.1-6.

Al-Asadi, J.N., 2018. Handgrip Strength in Medical Students: Correlation with Body Mass Index and Hand Dimensions. *Asian Journal of Medical Sciences*, 9, pp.21-26.

Badan Pusat Statistik Kota Administrasi Jakarta Barat., 2020. *Kecamatan Cengkareng Dalam Angka*, pp.1-114.

Chen, D., Zhu, Y., Ni, W., Li, Y., Yin, G., Shao, Z., & Zhu, J., 2023. Hand Grip Strength is Inversely Associated with Total Daily Insulin Dose Requirement in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study. *PeerJ*., pp.1-13.

Cooper, R., Tomlinson, D., Hamer, M., & Pereira, S.M.P., 2022. Lifetime Body Mass Index and Grip Strength at Age 46 Years: The 1970 British Cohort Study. *J Cachexia Sarcopenia Muscle*, 13, pp.1-10.

Fauzi, L., Handayani, O.W.K., Susilo, M.T., Kurnia, A.R., Rahayu, S.R., Irawan, F.A., Horng Lu, F.J., Lin, C., Lai, M.F., & Yu, Y.C., 2022. Obesity in Indonesian and Taiwanese Adolescents Related to Self Perception, Diet, Exercise, and Body Image. *KEMAS*, 17(3), pp.453-461.

Gamayanti, K.A.V., Aryana, I.G.P.S., & Gotera, W., 2023. Hubungan Antara Kekuatan Genggaman Tangan Dengan Kadar Gula Darah Sewaktu Pada Lansia Di Desa Melinggih, Kecamatan Payangan, Kabupaten Gianyar. *Intisari Sains Medis*, 14(2), pp.483-488.

Giglio, B.M., Mota, J.F., Wall, B.T., & Pimentel, G.D., 2018. Low Handgrip Strength is Not Associated With Type 2 Diabetes Mellitus and Hyperglycemia: A Population-Based Study. *Clin Nutr Res*., 7(2), pp.112-116.

Hammed, A.I., & Obaseki, C.O., 2017. Interdependence of Body Mass Index with Handgrip Strength and Endurance Among Apparently Healthy Teenagers. *Turk J Kin*., 4, pp.1-7.

Handayani, M.D.N., Sadewa, A.H., Farmawati, A., & Rochmah, W., 2018. Anthropometric Prediction Equations for Estimating Muscle Mass of Elderly Women. *KEMAS*, 14(2),pp.195-204.

Hardy, R., Cooper, R., Sayer, A.A., Shlomo, Y.B., Cooper, C., Deary, I.J., Demakakos, P., Gallacher, J., Martin, R.M., McNeill, G., Starr, J.M., Steptoe, A., Syddall, H., & Kuh, D., 2013. Body Mass Index, Muscle Strength, and Physical Performance in Older Adults From Eight Cohort Studies: The Halcyon Programme. *PLoS One*, 8(2), pp.e56483.

Heidy., Djuartina, T., & Irawan, R., 2019. Korelasi Kekuatan Genggaman Tangan Dengan Karakter Antropometri Lengan Bawah dan Tangan Serta Indeks Massa Tubuh. *Damianus Journal of Medicine*,18, pp.1-7.

Ilmi, A.F., & Utari, D.M., 2020. Hubungan Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul (RLPP) Terhadap Kadar Glukosa Darah Puasa Pada Mahasiswa. *Journal of Nutrition College*, 9, pp.222-227.

Jaafar, M.H., Ismail, R., Ismail, N.H., Isa, Z.M., Tamil, A.M., Nasir, N.M., Keat, N.K., Razak, N.H., Abidin, N.Z., & Yusof, K.H., 2023. Normative Reference Values and Predicting Factors of Handgrip Strength For Dominant

and Non-Dominant Hands Among Healthy Malay Adults in Malaysia. *BMC Musculoskelet Disord*., 24, pp.1-9.

Joo, K.C., Son, D.H., & Park, J.M., 2022. Association Between Relative Handgrip Strength and Insulin Resistance in Korean Elderly Men Without Diabetes: Findings Of The 2015 Korea National Health Nutrition Examination Survey. *Korean J Fam Med*., 43, pp.199-205.

Krakauer, N.Y., & Krakauer, J.C., 2020. Association of Body Shape Index (ABSI) with Hand Grip Strength. *Int J Environ Res Public Health*,17, pp.1-12.

Kurniawan, A., Widjaja, D., & Lugito, N.P.H., 2018. *Mean and Cutoff Value of Hand Grip Strength For Healthy Indonesian Young Adults*. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.

Leong, D.P., Teo, K.K., Rangarajan, S., Kutty, R., Lanas, F., Hui, C., Quanyong, X., Zhenzhen, Q., Jinhua, T., Noorhassim, I., AlHabib, K.F., Moss, S.J., Rosengren, A., Akalin, A.A., Rahman, O., Chifamba, J., Orlandini, A., Kumar, R., Yeates, K., Gupta, R., Yusufali, A., Dans, A., Avezum, A., Lopez-Jaramillo, P., Poirier, P., Heidari, H., Zatonska, K., Iqbal, R., Khatib, R., & Yusuf, S., 2016. Reference Ranges of Handgrip Strength From 125,462 Healthy Adults in 21 Countries: A Prospective Urban Rural Epidemiologic (PURE) Study. *J Cachexia Sarcopenia Muscle*,7, pp.535-546.

Mainous, A.G., Tanner, R.J., Anton, S.D., & Jo, A., 2015. Grip Strength as A Marker of Hypertension and Diabetes in Healthy Weight Adults. *Am J Prev Med*, 49(6), pp.850-858.

Manoharan, V.S., Sundaram, S.G., & Jason, J.I., 2015. Factors Affecting Hand Grip Strength and Its Evaluation: A Systemic Review. *Int J Physiother Res*., 3(6), pp.1288-1293.

McGrath, R., Johnson, N., Klawitter, L., Mahoney, S., Trautman, K., Carlson, C., Rockstad, E., & Hackney, K.J., 2020. What Are The Association Patterns Between Handgrip Strength and Adverse Health Conditions? A Topical Review. *SAGE Open Medicine*, 8, pp.1-12.

Nakanishi, S., Shimoda, M., Kimura, T., Sanada, J., Fushimi, Y., Iwamoto, Y., Iwamoto, H., Dan, K., Mune, T., Kaku, K., & Kaneto, H., 2024. The Impact of Handgrip Strength and Waist Circumference on Glycemic Control: Prospective, Observational Study Using Outpatient Clinical Data in Japanese Patients With Type 2 Diabetes Mellitus. *J Diabetes Investig*., 15(7), pp.892-898.

Nathania, N.P.S., Nugraha, M.H.S., Primayanti, I.D.A., & Saraswati, P.A.S., 2023. Handgrip Strength is Associated With Balance in Elderly Women. *Majalah Ilmiah Fisioterapi Indonesia*, 11, pp.70-75.

Gubernur Provinsi Daerah Khusus Ibukota Jakarta., 2017. *Peraturan Gubernur Provinsi Daerah Khusus Ibukota Jakarta Nomor 7 tahun 2017 Tentang Penanganan Prasarana dan Sarana Umum Tingkat Kelurahan*. Jakarta 2017.

Richter, E.A., & Hargreaves, M., 2013. Exercise, GLUT4, and Skeletal Muscle Glucose Uptake. *Physiol Rev*., 93(3), pp.993-1017.

Rokhmah, F.D., Handayani, D., & Al-Rasyid, H., 2015. Korelasi Lingkar Pinggang dan Rasio Lingkar Pinggang-Panggul Terhadap Kadar Glukosa Plasma Menggunakan Tes Toleransi Glukosa Oral. Jurnal Gizi Klinik Indonesia,12, pp.28-35.

Rondhianto., Ridla, A.Z., & Hasan, H., 2024. Sociodemographic Factors Affecting Diabetic Dietary Behavior in People with Type 2 Diabetes Mellitus. *KEMAS*, 19(3), pp.429-437.

Safitri, I., Setyarsih, L., Susanto, H., Suhartono., & Fitranti, D.Y., 2020. The Effect of Low and High Glycemic Load Diet on Muscle Fatigue of Young Soccer Athletes. *KEMAS*, 16(1), pp.111-120.

Schrager, M.A., Metter, E.J., Simonsick, E., Ble, A., Bandinelli, S., Lauretani, F., & Ferrucci, L., 2007. Sarcopenic Obesity and Inflammation in The Inchianti Study. *J Appl Physiol*., 102(3), pp.919-925.

Sirajudeen, M.S., Shah, U.N., Pillai, P.S., Mohasin, N., & Shantaram, M., 2012. Correlation Between Grip Strength and Physical Factors in Men. *International Journal of Health and Rehabilitation Sciences*, 1, pp.58-63.

Soenyoto, T., Mollap, K., & Mungpong, J., 2017. Correlation of Energy and Protein Consumption Levels with Physical Endurance of Rhythmic Gymnast Athletes. *KEMAS*, 13(1), pp.131-136.

Soraya, N., & Parwanto, E., 2023. The Controversial Relationship Between Body Mass Index and Handgrip Strength in The Elderly: An Overview. *Malays J Med Sci*., 30, pp.73-83.

Vaishya, R., Misra, A., Vaish, A., Ursino, N., & D'Ambrosi, R., 2024. Hand Grip Strength as A Proposed New Vital Sign Of Health: A Narrative Review of Evidences. *Journal of Health, Population and Nutrition*, 43, pp.1-

14.
Widjaja, D., Tjhai, K., Dermawan, K., Kalim, J., Tanzil, S., Pramusinta, A., Phenca, H.K., Kurniawan, A., 2018. *Correlations Between Hand Grip Strength and Anthropometric Status in Young Indonesian Adults*. World Congress on Osteoporosis, Osteoarthritis and Musculoskeletal Diseases; Krakow, Poland.
Zaccagni, L., Toselli, S., Bramanti, B., Gualdi-Russo, E., Mongillo, J., & Rinaldo, N., 2020. Handgrip Strength in Young Adults: Association With Anthropometric Variables and Laterality. *Int J Environ Res Public Health*, 17, pp.1-18.