Artikel Penelitian

STRONGER HANDS, STRONGER BLADDERS: UNCOVERING THE CONNECTION BETWEEN HANDGRIP STRENGTH AND URINARY INCONTINENCE IN ELDERLY WOMEN

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Abstract

Urinary incontinence (UI) is a prevalent issue among elderly women, significantly impacting their quality of life. Handgrip strength, an indicator of overall muscle strength, is understudied in its role concerning UI. Utilizing handgrip strength to measure overall muscle strength, including pelvic floor muscles, introduces a novel approach to supporting continence maintenance in elderly women. The aim is to determine the correlation between handgrip strength and UI severity among elderly women, using the International Consultation on Incontinence – Short Form (ICIQ-SF) for measurement. This study involved 74 elderly female participants at Bina Bhakti Nursing Home. Spearman's correlation was employed to analyze the relationship between handgrip strength (in kilograms), measured with the Omron Handgrip Strength device on the right hand, and UI severity was assessed through the ICIQ-SF scoring questionnaire, with scores ranging from 0 to 21. Findings indicated a statistically significant negative correlation between handgrip strength and UI severity (r = -0.245, p = 0.035). This suggests that higher handgrip strength correlates with lower UI severity. The study found a significant correlation between handgrip strength and UI in elderly women, indicating that strength-building interventions may reduce UI severity.

***Keywords**: elderly women, handgrip strength, ICIQ-SF, muscle strength, urinary incontinence*

INTRODUCTION

As social living standards have risen, the adverse impact of incontinence on the quality of life and social dignity of older people has emerged as a significant medical and social issue. The intersection between musculoskeletal health and urinary function is an emerging area of interest in geriatric medicine, particularly in elderly women.(Li *et al*., 2024) This association is thought to result from age-related declines in muscle mass and strength, which affect the pelvic floor muscles and contribute to urinary incontinence.(Li *et al*., 2024; Wen *et al*., 2023) Current assessment tools for pelvic floor muscles are often invasive, subjective, and costly. This research aims to identify a simpler, more convenient, and objective indicator to evaluate pelvic floor muscle function.(Baschung Pfister *et al*., 2018; Li *et al*., 2024) Chiu *et al*. found that urine stream is associated with low muscle strength not only in skeletal muscles but also in smooth muscles, such as the detrusor muscles, in a healthy male population across various ages. This finding may aid in identifying the causes of urinary dysfunction. Hand grip strength has been proposed as a biomarker for overall health.(Bohannon, 2019) This study aims to examine the correlation between handgrip strength and UI, particularly in elderly women. Most existing studies focus on other indicators of muscle strength, male participants, and unspecified age ranges.

According to Sharfina et al., the highest prevalence of UI 52,17% was observed in the 50-59 age group and increased with age.(Wardani *et al*., 2017) Examining UI by gender, women have a significantly higher prevalence compared to men.(Yavuz & Etiler, 2023) In terms of childbirth

history, the prevalence was 5% in nulliparous women, 10.25% in primiparous women, 23.61% in women with two childbirths, and 26.67% in those with three or more childbirths. The prevalence of urinary incontinence was 19.90%, with stress UI at 7.33%, urgency UI at 9.43%, and mixed UI at 3.14%. (Wardani *et al*., 2017)

Urinary incontinence, the loss of bladder control is the unintentional release of urine due to involuntary or abnormal urine loss.(Davis *et al*., 2020; Demaagd & Davenport, 2012) It encompasses various types of etiology stress, urge, mixed, overflow, and functional urinary incontinence. Stress urinary incontinence is a frequent condition marked by the unexpected and involuntary release of urine during actions that raise abdominal pressure, like laughing, sneezing, coughing, or physical exertion. (Lugo *et al*., 2024) Inadequate bladder habits, such as prolonged urine retention, have detrimental effects on the strength and function of pelvic floor muscles.(Gonzalez *et al*., 2020) Women who experience spontaneous vaginal delivery or instrumental delivery are at an increased risk of developing urinary incontinence in their later life. According to MacArthur *et al.,* urinary incontinence symptoms can persist for up to 6 years after the first birth.(MacArthur *et al*., 2006; Saadia, 2015)

Urge incontinence often arises from issues with the detrusor muscle of the urinary bladder, a specialized smooth muscle within the bladder wall. Causes include detrusor muscle overactivity, poor detrusor compliance, and bladder hypersensitivity.(Nandy & Ranganathan, 2024) Mixed urinary incontinence involves the involuntary leakage of urine due to both stress and urge incontinence. Advanced pelvic organ prolapse (POP) leads to bladder outlet obstruction, resulting in detrusor muscle neuropathy from overstretching. This causes the bladder to overreact to neurotransmitters and lose muscle fiber synchronization, making it irritable and overactive. (Harrison *et al*., 1990; Lo *et al*., 2020)

Overflow incontinence occurs when the bladder is unable to empty properly, resulting in urine leakage due to weakened detrusor muscles and obstructed bladder outlets. Neurologic disorders, including spinal cord injuries, multiple sclerosis, and diabetes, can cause a neurogenic bladder. Masses in the abdomen or pelvis can cause obstruction, as can tumors from bladder cancer, which can block the urethra and lead to symptoms like dribbling after urination.(Bagnola *et al*., 2017; Leslie *et al*., 2014)

Functional incontinence is often observed in older adults due to environmental or physical barriers to toileting. It can result from mobility limitations, such as those following a hip fracture, which may temporarily prevent independent transfers on and off a toilet. As the underlying mobility issue improves, this condition may be resolved. In other cases, such as dementia from Alzheimer's disease or vascular disorders, patients may not recognize the sensation of a full bladder or may struggle with essential tasks, such as using the toilet.(Griebling, 2009; Leslie *et al*., 2014)

METHOD

Research Design and Subject

To investigate the connection between handgrip and urinary incontinence, we conducted a primary analysis involving 74 elderly female participants at Bina Bhakti Nursing Home in May 2024. Participants ranged from 61-97 years old. The inclusion criteria for this study were a minimum age of 60 years and willingness to participate in the interviews. The elderly who were uncooperative, faced challenges in two-way communication, or lacked comprehension of the Indonesian language were excluded from this research.

Research Variables

The research variables included two components: handgrip and urinary incontinence. Handgrip strength, measured in kilograms, was assessed using the Omron™ Handgrip Strength dynamometer. Participants were instructed to grasp the dynamometer firmly with their left hand, hold it for a few seconds while the force was recorded, and then release it. The left hand can offer valuable insights into a person's overall strength profile, especially in cases where the dominant

hand is more frequently used in daily activities, potentially skewing results. By focusing on the non-dominant hand, we reduce this bias, providing a more balanced assessment of grip strength across individuals with different levels of handedness.(Barrios *et al*., 2012; Incel *et al*., 2002)

UI severity was assessed through the ICIQ-SF scoring questionnaire, with scores ranging from 0 to 21. The question items include frequency of UI, amount of leakage, the overall impact of UI, and self-diagnostic items. Higher scores indicate greater severity UI and greater impact on quality of life.(Avery *et al*., 2004)

Statistical Analysis

Data analysis was conducted using SPSS version 26. The Kolmogorov-Smirnov test was applied to examine data distribution normality, while Spearman's Rho correlation test assessed the relationship between handgrip strength and urinary incontinence.

RESULTS AND DISCUSSION

This study examined elderly women, aged around 75 years, ranging from 61 to 97. All participants were female. On average, their handgrip strength was 8.55 kg, ranging from 1 kg to nearly 30 kg. Urinary incontinence severity was assessed using the ICIQ-SF scale, with scores ranging from 0 to 21. The average score among participants was 6.29, indicating a wide range of incontinence experiences. Such a range reflects the diversity in participants' health conditions, physical strength, and possibly lifestyle factors, all of which can impact incontinence severity.

As women get older, their urogenital system experiences several anatomical and physiological transformations. These include degeneration of muscles and axons, a decrease in bladder capacity, heightened detrusor activity, and a reduction in the strength of detrusor contractions. As a result, elderly women are more likely to experience UI. Additionally, women are more prone to this condition because of their unique anatomical, social, and cultural factors, as well as due to experiences like pregnancy, childbirth, and menopause.(Najafi *et al*., 2022) (Table 1)

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Table 1. Characteristics of Research Results

Parameter	N (%)	Mean (SD)	Med (Min-Max)
Age		74.75 (8.08)	75.50 (61 – 97)
Gender			
Female	74 (100)		
Handgrip		8.55 (5.96)	8.25 (1.00 – 29.70)
Urine Incontinence			
Yes	40 (54.1)		
No	34 (45.9)		
(ICIQ-SF)		6.29 (7.18)	3.5 (0 – 21)

With a sample size of 74, this research used the Kolmogorov-Smirnov test, which requires a minimum of 50 samples.(Mishra *et al*., 2019) The results from the normality tests show that the data for handgrip strength and the severity of urinary incontinence do not follow a normal distribution. This conclusion is based on p-values below 0.05 from Kolmogorov-Smirnov tests. It is suggested that lower handgrip strength is associated with a higher severity of urinary incontinence among elderly women, highlighting the potential impact of muscle strength on urinary function.

Table 2. Normality Test

Parameter	Kolmogorov-Smirnov			Saphiro-Wilk		
	Statistic	***df***	***Sig.***	***Statistic***	***df***	***Sig.***
Urine Incontinence	0.269	74	0.000	0.810	74	0.000
Handgrip	0.113	74	0.020	0.929	74	0.000

These findings suggest that handgrip strength could serve as a convenient, non-invasive indicator of muscle health related to incontinence in elderly women. Specifically, a slight negative correlation was observed (r = -0.245), indicating that lower handgrip strength was associated with greater incontinence severity. In other words, individuals with weaker handgrip strength tended to experience more severe incontinence. This could make handgrip strength a simple tool for assessing health in this area, though further research is recommended to explore its potential as a measure of overall muscle health in older adults. This is different from Güzelant *et al*. which they explained found no notable difference in general muscle strength, as measured by hand grip strength, between women with POP and those without, indicating that hand grip strength might not effectively reflect pelvic floor muscle strength. Additionally, the study explored various factors that could contribute to POP, such as post-menopausal hormonal changes that reduce both muscle mass and estrogen, impacting muscle strength. Other risk factors, including obesity, were also considered and controlled for in the analysis. The accumulation of triglycerides in muscle cells can negatively affect muscle function and strength. This dysfunction may also impact the pelvic floor muscles, potentially increasing the risk of POP in obese individuals. (Aliye Yıldırım Güzelant *et al*., 2015)

Table 3. Spearman Correlation

		Urine Incontinence	**Handgrip**
Urine Incontinence	Correlation Coefficient	1.000	0.245
	Sig. (2-tailed)	-	0.035
Handgrip	Correlation Coefficient	-0.245	1.000
	Sig. (2-tailed)	0.035	-

The pelvic floor muscles act like a “hammock” beneath the urethra, providing necessary support. When these muscles lose mass due to sarcopenia, urinary functions are compromised resulting in UI because the urethra cannot withstand increased bladder pressure. Sarcopenia is characterized by a progressive loss of skeletal muscle mass and strength, which can be exacerbated by factors such as aging, physical inactivity, poor nutrition, and chronic diseases. The pelvic floor muscles, including the levator ani and associated connective tissues, play a crucial role in supporting the bladder and urethra. When sarcopenia weakens and causes atrophy in these muscles, their capacity to maintain pelvic support diminishes. This reduction in muscle strength can increase bladder pressure during activities like coughing or sneezing, potentially leading to stress urinary incontinence (SUI). Another factor that sarcopenia leads to such as the production of inflammatory cytokines and oxidative stress, can cause myopathy and neurodegeneration in the bladder, ultimately leading to an overactive bladder.(Ida *et al*., 2019; Yang *et al*., 2021) Cytokines like tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6) are recognized for their role in promoting muscle wasting through several mechanisms, including the activation of the ubiquitin-proteasome system, which enhances protein degradation in skeletal muscles. These inflammatory mediators can also cause myopathy in the detrusor muscle, resulting in weakened contractions and neurodegeneration in the bladder. This neurodegeneration may disrupt the signaling pathways that regulate bladder contractions, further complicating bladder function and raising the likelihood of overactive bladder (OAB) symptoms. After accounting for various inflammation-related conditions, including heart disease, lung disease, symptomatic osteoarthritis, and diabetes, a connection was found between cytokine levels and muscle mass/strength.(Visser *et al*., 2002) The results of this research study are similar to those of Yang *et al*., indicating that women with sarcopenia have a

higher rate of UI. Besides that, hormonal fluctuations, particularly those occurring during menopause, can decrease muscle tone in skeletal and smooth muscles due to diminished estrogen levels. This decline adversely affects grip strength and bladder function, establishing a correlation between handgrip strength and urinary incontinence symptoms.(Maltais *et al*., 2009; Yang *et al*., 2021)

Exploring preventive measures like pelvic floor muscle training (PFMT) and resistance exercises can be quite advantageous for SUI, urge and mixed urinary incontinence. Research indicates that these strengthening activities not only enhance handgrip strength but also alleviate symptoms of urinary incontinence by improving the stability of the pelvic floor. Highlighting the significance of early intervention through physical therapy could play a crucial role in slowing down the progression of sarcopenia and its impact on bladder function.

CONCLUSION

This research reveals that higher handgrip strength is associated with urinary incontinence among elderly women. The results suggest that handgrip strength could serve as a simple, non-invasive measure of overall muscle health, potentially offering a practical tool to help assess and manage urinary incontinence in older women.

REFERENCES

Aliye Yıldırım Güzelant, Nicel Taşdemir, Ayşe Banu Sarıfakıoglu, Remzi Abalı, & Cem Çelik. (2015). *Assesment of Hand grip Strength in Patients with Pelvic Organ Prolapse*. *06*(06). https://doi.org/10.4328/JCAM.2416

Avery, K., Donovan, J., Peters, T. J., Shaw, C., Gotoh, M., & Abrams, P. (2004). ICIQ: A brief and robust measure for evaluating the symptoms and impact of urinary incontinence. *Neurourology and Urodynamics*, *23*(4), 322–330. https://doi.org/10.1002/nau.20041

Bagnola, E., Pearce, E., & Broome, B. (2017). A Review and Case Study of Urinary Incontinence. *Madridge Journal of Nursing*, *2*(1), 27–31. https://doi.org/10.18689/mjn-1000105

Barrios, J., Verstraeten, W., Maes, P., Aerts, J.-M., Farifteh, J., & Coppin, P. (2012). Using the Gravity Model to Estimate the Spatial Spread of Vector-Borne Diseases. *International Journal of Environmental Research and Public Health*, *9*(12), 4346–4364. https://doi.org/10.3390/ijerph9124346

Baschung Pfister, P., de Bruin, E. D., Sterkele, I., Maurer, B., de Bie, R. A., & Knols, R. H. (2018). Manual muscle testing and hand-held dynamometry in people with inflammatory myopathy: An intra- and interrater reliability and validity study. *PLOS ONE*, *13*(3), e0194531. https://doi.org/10.1371/journal.pone.0194531

Bohannon, R. W. (2019). Grip Strength: An Indispensable Biomarker For Older Adults . *Clinical Interventions in Aging*, *Volume 14*, 1681–1691. https://doi.org/10.2147/CIA.S194543

Davis, N. J., Wyman, J. F., Gubitosa, S., & Pretty, L. (2020). Urinary Incontinence in Older Adults. *AJN, American Journal of Nursing*, *120*(1), 57–62. https://doi.org/10.1097/01.NAJ.0000652124.58511.24

Demaagd, G. A., & Davenport, T. C. (2012). Management of urinary incontinence. *P & T : A Peer-Reviewed Journal for Formulary Management*, *37*(6), 345-361H.

Gonzalez, G., Vaculik, K., Khalil, C., Zektser, Y., Arnold, C., Almario, C. V., Spiegel, B. M. R., & Anger, J. T. (2020). Women's Experience with Stress Urinary Incontinence: Insights from Social Media Analytics. *Journal of Urology*, *203*(5), 962–968. https://doi.org/10.1097/JU.0000000000000706

Griebling, T. L. (2009). Urinary Incontinence in the Elderly. *Clinics in Geriatric Medicine*, *25*(3), 445–457. https://doi.org/10.1016/j.cger.2009.06.004

HARRISON, S. C. W., FERGUSON, D. R., & DOYLE, P. T. (1990). Effect of Bladder Outflow Obstruction on the Innervation of the Rabbit Urinary Bladder. *British Journal of Urology*, *66*(4), 372–379. https://doi.org/10.1111/j.1464-410X.1990.tb14957.x

Ida, S., Kaneko, R., Nagata, H., Noguchi, Y., Araki, Y., Nakai, M., Ito, S., Imataka, K., & Murata, K. (2019). Association between Sarcopenia and Overactive Bladder in Elderly Diabetic Patients. *The Journal of Nutrition, Health & Aging*, *23*(6), 532–537. https://doi.org/10.1007/s12603-019-1190-1

Incel, N. A., Ceceli, E., Durukan, P. B., Erdem, H. R., & Yorgancioglu, Z. R. (2002). Grip strength: effect of hand dominance. *Singapore Medical Journal*, *43*(5), 234–237.

Leslie, S. W., Tran, L. N., & Puckett, Y. (2014). Urinary Incontinence. *StatPearls*. https://www.ncbi.nlm.nih.gov/books/NBK559095/

Li, L., Chen, F., Li, X., Gao, Y., Wang, N., & Xu, T. (2024). Association between low handgrip strength and incontinence among Chinese middle-aged and older people: A cross-sectional study. *AGING MEDICINE*, *7*(3), 360–367. https://doi.org/10.1002/agm2.12309

Lo, T. S., Uy-Patrimonio, M., Kao, C., Chua, S., Huang, T.-X., & Wu, M.-P. (2020). Urodynamics mixed type urinary incontinence with advanced pelvic organ prolapse, management and outcomes. *Scientific Reports*, *10*. https://doi.org/10.1038/s41598-020-58594-3

Lugo, T., Leslie, S. W., Mikes, B. A., & Riggs, J. (2024). *Stress Urinary Incontinence*. StatPearls. https://www.ncbi.nlm.nih.gov/books/NBK559095/

MacArthur, C., Glazener, C. M., Wilson, P. D., Lancashire, R. J., Herbison, G. P., & Grant, A. M. (2006). Persistent urinary incontinence and delivery mode history: a six-year longitudinal study. *BJOG: An International Journal of Obstetrics & Gynaecology*, *113*(2), 218–224. https://doi.org/10.1111/j.1471-0528.2005.00818.x

Maltais, M. L., Desroches, J., & Dionne, I. J. (2009). Changes in muscle mass and strength after menopause. *Journal of Musculoskeletal & Neuronal Interactions*, *9*(4), 186–197. http://www.ncbi.nlm.nih.gov/pubmed/19949277

Mishra, P., Pandey, C., Singh, U., Gupta, A., Sahu, C., & Keshri, A. (2019). Descriptive statistics and normality tests for statistical data. *Annals of Cardiac Anaesthesia*, *22*(1), 67. https://doi.org/10.4103/aca.ACA_157_18

Najafi, Z., Morowatisharifabad, M. A., Jambarsang, S., Rezaeipandari, H., & Hemayati, R. (2022). Urinary incontinence and related quality of life among elderly women in Tabas, South Khorasan, Iran. *BMC Urology*, *22*(1), 214. https://doi.org/10.1186/s12894-022-01171-9

Nandy, S., & Ranganathan, S. (2024). *Urge Incontinence*. StatPearls. https://www.ncbi.nlm.nih.gov/books/NBK563172/

Saadia, Z. (2015). Relationship between mode of delivery and development of urinary incontinence: A possible link is demonstrated. *International Journal of Health Sciences*, *9*(4), 446–452.

Visser, M., Pahor, M., Taaffe, D. R., Goodpaster, B. H., Simonsick, E. M., Newman, A. B., Nevitt, M., & Harris, T. B. (2002). Relationship of Interleukin-6 and Tumor Necrosis Factor- With Muscle Mass and Muscle Strength in Elderly Men and Women: The Health ABC Study. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *57*(5), M326–M332. https://doi.org/10.1093/gerona/57.5.M326

Wardani, R. S., Judistiani, R. T. D., & Siddiq, A. (2017). Prevalence of Urinary Incontinence in Women aged 20–59 years in Community Dwellings. *Althea Medical Journal*, *4*(2), 178–183. https://doi.org/10.15850/amj.v4n2.1070

Wen, Z., Gu, J., Chen, R., Wang, Q., Ding, N., Meng, L., Wang, X., Liu, H., Sheng, Z., & Zheng, H. (2023). Handgrip Strength and Muscle Quality: Results from the National Health and Nutrition Examination Survey Database. *Journal of Clinical Medicine*, *12*(9), 3184. https://doi.org/10.3390/jcm12093184

Yang, S.-J., Park, J. H., Oh, Y., Kim, H., Kong, M., & Moon, J. (2021). Association of decreased grip strength with lower urinary tract symptoms in women: a cross-sectional study from Korea. *BMC Women's Health*, *21*(1), 96. https://doi.org/10.1186/s12905-021-01241-4

Yavuz, M., & Etiler, N. (2023). Addressing urinary incontinence by gender: a nationwide population-based study in Turkiye. *BMC Urology*, *23*(1), 205. https://doi.org/10.1186/s12894-023-01388-2