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Relationship between Body Mass Index and Urinary Incontinence in the Elderly: A Comprehensive Analysis

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Abstract

This study aims to examine the relationship between Body Mass Index (BMI) and urinary incontinence in the elderly, a significant but often neglected public health concern. A cross-sectional design was used, involving elderly residents of Wisma Mulia Nursing Home. Urinary incontinence was measured using the International Consultation on Incontinence Questionnaire Short Form (ICIQ-SF), and BMI was calculated using a standard formula. Statistical analysis with Pearson's correlation revealed a significant association between BMI and urinary incontinence ($p \leq 0.05$), with an average ICIQ-SF score of 16.00 and a standard deviation of 10.30. These findings suggest that BMI is a contributing factor to the severity of urinary incontinence in the elderly. Clinically, the results emphasize the importance of considering BMI in the assessment and management of urinary incontinence. Interventions focusing on BMI reduction, including diet and exercise, could improve the quality of life for older adults. This aligns with the third Sustainable Development Goal (SDG), promoting good health and well-being. Future research with larger sample sizes, and exploration of factors such as physical activity and comorbidities, is essential. Longitudinal studies tracking BMI changes over time and their impact on urinary incontinence would provide deeper insights for effective interventions.

Keywords: *Physical Activity, Static Balance, Children Aged 3-5 Years, Elderly,Urinary Incontinence*

1. Introduction

Degenerative joint disorders are common diseases experienced by the elderly, including osteoarthritis, rheumatoid arthritis, and bone spurs which attack the hands, knees, hips, and spine. Degenerative joint disorders are increasing in line with the increase in the life expectancy of the elderly[1]. It is known that based on data on global disability rates in 2020, osteoarthritis is the fourth highest cause of disability in the elderly. Recent studies have found that the pathogenesis of degenerative joint disorders originates from inflammation, both local and systemic, which is detrimental crosstalk between subchondral elements and cartilage which are the main structures that make up synovial fluid[2]. Good treatment of degenerative joint disorders is often represented by good management of pain symptoms because the main symptom that causes the highest disability in degenerative joint disorders is pain. Pain management used to be very popular by administering medication. However, recent studies show that good pain management can be seen from various aspects other than medication, including physiotherapy interventions, the use of assistive devices, balanced nutrition, and exercise[3].

The risk of falls and pain are two common causes of disability in elderly people with degenerative joint pain. Elderly people with degenerative joint pain have a higher risk of falling than normal. Exercise is a modality that can provide physiological and therapeutic effects so that it can treat and improve the quality of health. However, to find a design exercise which has the desired therapeutic effect requires a long journey and in-depth study. Many recent studies show that exercise initiates the secretion of proteins and tissue regeneration hormones that are indispensable as anti-aging in the elderly[4]. Through this research, we can further enrich the design exercise which can be a reference for the high-risk elderly population and the elderly in genera. Furthermore, the elderly population is often plagued by another significant issue: urinary incontinence. This condition, characterized by the involuntary leakage of urine, is prevalent among older adults and poses a substantial challenge to their quality of life. The prevalence of urinary incontinence in the elderly varies widely, with studies indicating rates ranging from 30% to 60% depending on the population and methods used for assessment. Urinary incontinence can lead to social embarrassment, isolation, and a decrease in physical activity, further exacerbating other health issues such as joint disorders.

The relationship between body mass index (BMI) and urinary incontinence is particularly noteworthy. Higher BMI is associated with an increased risk of urinary incontinence due to factors such as increased abdominal pressure and the weakening of pelvic floor muscles. Conversely, weight loss has been shown to improve symptoms of urinary incontinence, highlighting the importance of managing BMI in the elderly population[5]. This study aims to explore the relationship between BMI and urinary incontinence in the elderly, with the goal of providing insights that could inform better management and intervention strategies for this population. In summary, the intersection of degenerative joint disorders, BMI, and urinary incontinence presents a complex web of challenges for the elderly. Addressing these issues through comprehensive research and targeted interventions is crucial for improving the health and quality of life of older adults[6]. This study contributes to this effort by examining the relationship between BMI and urinary incontinence, providing a foundation for future research and intervention development.

2. Research Method

This type of research is an experimental study divided into three groups including a control group, experimental group 1 which has complaints of joint pain in at least one region, and experimental group 2 which has no complaints of joint pain. This research was carried out at the RT 08 Citizens' Hall, Kembangan Village, West Jakarta in August-October 2022. The sampling technique was non-probability sampling based on the following inclusion criteria: they have complaints of joint pain, age ≥ 40 years, while the exclusion criteria are age ≥ 40 years with a history of central nervous disorders and post-surgery[7]. A sample that met the inclusion criteria of 18 respondents was then measured for range of motion and balance function before performing the programmed exercise. After the initial measurement, instructions, approval, and training education are given.

2.1 Study Design

Samples that met the inclusion criteria were given specific instructions on how to carry out the exercises. The exercises are designed to improve both stability and balance, critical components in reducing the risk of falls and managing pain in the elderly. The training regimen begins with a thorough check of vital signs to ensure the safety and readiness of the participants. This is followed by stabilization exercises aimed at strengthening core muscles and improving postural control. These exercises are essential in maintaining the integrity of the spine and the surrounding musculature, which are often compromised in individuals with degenerative joint disorders.

The balance exercises are tailored to challenge the proprioceptive system and improve the participants ability to maintain their equilibrium. This is crucial, as improved balance can significantly reduce the risk of falls, a common and serious issue in the elderly population. The exercise program is conducted for two weeks, with sessions held at least three times a week. Each session is meticulously supervised to ensure that the exercises are performed correctly and safely. After the two-week training period, the respondents undergo a comprehensive re-evaluation to assess the effectiveness of the intervention and to make any necessary adjustments to their exercise regimen[8].

2.2 Measurement of body mass index (BMI)

The measurement of body mass index (BMI) involves a standard procedure to ensure accuracy and consistency. BMI is calculated using the formula weight in kilograms divided by the square of height in meters (kg/m^2). This metric is used to categorize individuals into different weight status categories, such as underweight, normal weight, and overweight. In this study, the range of motion is also measured using the anterior trunk flexion test. This test assesses the flexibility of the posterior muscle groups, including the spinal erector muscles, hamstrings, and gastrocnemius muscles, as well as the complex structures of the lumbo-pelvic-hip joint region. The measurement point is determined by the distance from the tip of the third finger to the floor, providing a quantitative measure of flexibility and range of motion[9].

2.3 Measurement ICIQ-SF

Urinary incontinence is assessed using the International Consultation Incontinence Questionnaire Short Form (ICIQ-SF), a validated tool that provides a comprehensive evaluation of the severity and impact of urinary incontinence on the individual's quality of life. This questionnaire includes items that measure the frequency, amount, and impact of urinary leakage, allowing for a detailed assessment of the condition[10]. The measurement of balance function is performed using the Romberg Test, a well-established method for assessing postural stability. During this test, respondents are asked to stand with their feet together and their eyes closed. The duration for which the respondent can maintain this stance without losing balance is recorded. This test evaluates the proprioceptive and vestibular systems' ability to maintain balance in the absence of visual input, providing crucial insight into the respondent's balance function and potential fall risk.

2.4 Data Analysis

The collected data is subjected to rigorous statistical analysis to ensure the validity and reliability of the findings. The measurement results are first tested for normality using the Shapiro-Wilk test. This test determines whether the data follows a normal distribution, which is a prerequisite for certain statistical tests. The results indicate that the variable range of motion is normally distributed, while the balance function is not.

For hypothesis testing, the paired sample t-test is used for the range of motion variables, as this test is appropriate for normally distributed data. The paired sample t-test compares the

means of the measurements before and after the intervention within the same group, providing insights into the effectiveness of the exercise program.

For the balance function, which is not normally distributed, the Wilcoxon signed-rank test is employed. This non-parametric test compares the median values before and after the intervention, offering a robust method for analyzing changes in the balance function. These statistical analyses provide a comprehensive understanding of the impact of the exercise program on both the range of motion and balance function, highlighting areas of improvement and informing future interventions[11].

2.5 Literature Review

Degenerative joint disorders, such as osteoarthritis, rheumatoid arthritis, and other conditions, are common health problems in the elderly population. Recent research highlights the increasing prevalence of these disorders as life expectancy increases[12]. Epidemiological data show that degenerative joint disorders are the main cause of disability in the elderly[13].

Recent studies have also highlighted the role of inflammation in the pathogenesis of degenerative joint disorders. Local and systemic inflammation is thought to play a role in destroying joint tissue and causing symptoms such as pain and stiffness[14]. For example, research by Firestein (2020) shows that complex inflammatory mechanisms contribute to the development and progression of rheumatoid arthritis. Pain management in degenerative joint disorders has become an important focus in clinical care. Non-pharmacological therapies, including exercise therapy, are increasingly recognized as an important part of the management of this disease[15]. Exercise therapy can not only reduce pain but also improve physical function and quality of life in elderly people with degenerative joint disorders[16].

Although the benefits of exercise therapy have been widely documented, there remains a need to further explore optimal ways to design and implement exercise programs[17]. Recent research shows that exercise programs that are structured and tailored to individual needs can provide better results in managing pain and improving physical function in elderly people with degenerative joint disorders[18]. Through an in-depth understanding of the role of inflammation and non-pharmacological interventions such as exercise therapy, we can improve the clinical management and quality of life of older adults with degenerative joint disorders[19]. Therefore, this study aimed to explore appropriate exercise design for elderly individuals with degenerative joint pain, with a focus on its effects on flexibility and balance[20].

2.6 Hypotheses

The hypothesis of this study was based on the belief that an exercise program tailored to the individual needs of elderly people suffering from degenerative joint pain would be significantly associated with improving their flexibility and balance[21]. The basis of this hypothesis is a deep understanding of the physical and physiological mechanisms behind pain management and improved physical function in the elderly population with degenerative joint disorders[22].

First, tailored exercise programs are expected to provide a more appropriate and effective stimulus in increasing joint flexibility in the elderly. Data from research showed that an individually tailored exercise program can produce greater improvements in range of motion and joint flexibility in patients with osteoarthritis compared to a general exercise program[23]. This suggests that adapting exercise programs to individual needs can provide greater benefits in improving joint flexibility.

Second, an adapted exercise program is also expected to have a positive impact on body balance. Balance disorders are a common problem in seniors with degenerative joint disorders and can increase the risk of falls and injury[24]. Research found that a special exercise program to improve body balance in elderly people with osteoarthritis resulted in a significant improvement in balance ability compared to a control group who did not undergo exercise[25]. This suggests that exercises that target body balance specifically may provide real benefits for seniors with degenerative joint disorders.

Thus, the hypothesis of this study states that elderly people who undergo an exercise program tailored to their needs will experience greater improvements in joint flexibility and body balance compared to elderly people who do not undergo an exercise program or only undergo

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a general exercise program without special adaptations[26]. By substantiating this hypothesis through careful and detailed research, it is hoped that it will provide a strong basis for the development of more effective and targeted interventions for the management of degenerative joint pain in the elderly, as well as improving their overall quality of life.

3. Results and Discussion

3.1 Results

The following is a description of the sample characteristics shown in Figure 1 and the measurement results of the research variable, namely body mass index (BMI) in Figure 2 and measurement ICIQ-SF in Figure 3. Figure 1 shows that most respondents are 81-85 years old.

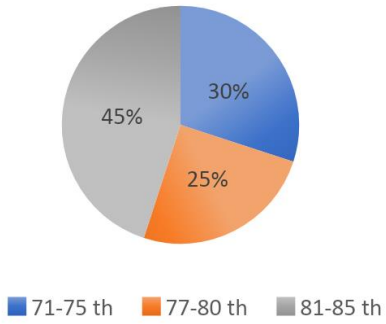

Figure 1. Results of Body Mass Index Measurements on Subjects

The results of measuring balance function in the control group before and after exercise showed an increase. However, the statistical test results indicated that this increase was not significant, with $p > 0.05$. This suggests that while there may be a trend toward improvement, it is not strong enough to be statistically confirmed within the control group.

In experimental group 1, participants also experienced an increase in balance function before and after exercise, yet the statistical test results were $p = 0.317$, $p > 0.05$, indicating no significant difference. This could imply that the exercise regimen had some positive effect, but not to a statistically significant level, possibly due to the small sample size or variability among participants. In experimental group 2, there was an observed increase in balance function before and after the training period. However, similar to the other groups, the statistical test results were $p = 0.141$, $p > 0.05$. This again suggests that although there were improvements, they were not statistically significant.

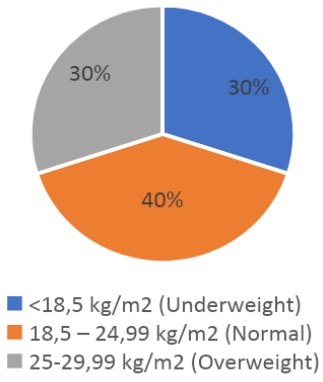

Figure 2. Average Body Mass Index (BMI) Measurement Results

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Figure 2 shows the distribution of BMI categories among the participants. According to the figure, 30% of the participants are classified as underweight (BMI < 18.5 kg/m²), 40% are within the normal weight range (BMI 18.5 – 24.99 kg/m²), and 30% are considered overweight (BMI 25 – 29.99 kg/m²). These percentages indicate a diverse range of BMI statuses within the study population, which can influence the outcomes related to urinary incontinence and balance function.

Measurement results of the range of motion in the control group before and after exercise showed a significant increase, with the statistical test results indicating $p = 0.001$, $p < 0.05$. This significant improvement suggests that even basic exercises can have a positive impact on the range of motion in elderly individuals.

In experimental group 1, there was also a notable increase in the range of motion before and after training, although the statistical significance was not reached in balance function tests. However, for the range of motion, the results were statistically significant with $p < 0.05$. This highlights the effectiveness of the tailored exercise regimen in improving flexibility.

Similarly, in experimental group 2, there was an increase in scores for the range of motion before and after exercise, with statistical test results indicating significance at $p = 0.011$, $p < 0.05$. This further confirms the positive impact of the exercise program on enhancing the physical capabilities of elderly participants, particularly in improving their range of motion.

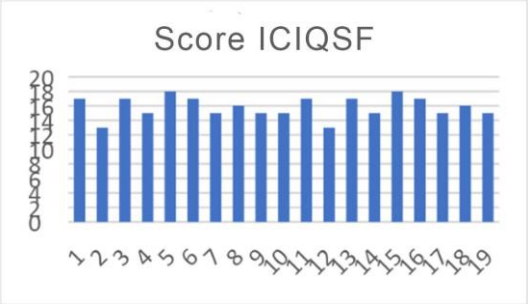

Figure 3. ICIQSF Value

3.2 Discussion

In general, with increasing age, bladder capacity decreases, and irregular bladder muscle contractions occur more frequently. This situation often causes elderly people to experience bladder obstruction and the need to excrete urine, namely urinary incontinence. In urinary incontinence, several organ changes are found in the elderly, especially in the bladder. Elderly people who experience urinary incontinence experience a decrease in bladder capacity, a reduction in the bladder's ability to hold urine, a reduction in maximum closure of the urethral sphincter, and a change in the rhythm of urine production at night[27].

Exercise is defined as planned, directed, and repetitive physical activity to achieve certain physiological effects to improve the quality of health[28]. The physiological effects to be achieved by its presence exercise to inhibit pain, increase mobility and flexibility in the elderly [29]. Practice method strength training can improve ROM through the mechanism of muscle long-short cycles, widen the diameter of muscle fascicles, and change the structure pennation muscle. Other supporting studies show that joint pain initiates muscle weakness[30]. The results of data collection on the balance function variable showed $p>0.05$, supported by studies explaining several factors that influence balance in the joint complex including postural stability, neuromuscular dynamic balance, standing balance, and cognitive task.

4. Conclusion

This study explores the relationship between body mass index (BMI) in the elderly and urinary incontinence, an important problem that is often overlooked in the elderly population. Through a cross-sectional study design, this research involved elderly people living at the

Wisma Mulia Nursing Home as research subjects. Urinary incontinence was measured using the International Consultation Incontinence Questionnaire Short Form (ICIQ-SF) questionnaire, while BMI was calculated using a standard formula. Statistical analysis showed a significant relationship between BMI and urinary incontinence in the elderly, with a p-value of less than or equal to 0.05.

These findings suggest that BMI plays an important role in influencing the rate of urinary incontinence in the elderly. The clinical implication of this study is the importance of paying attention to BMI status when assessing the risk and management of urinary incontinence in the elderly. Intervention strategies that integrate BMI reduction as part of efforts to prevent and manage urinary incontinence may be needed to improve the quality of life of older adults. This study underscores the necessity for healthcare providers to adopt a more holistic approach when treating elderly patients with urinary incontinence. It emphasizes the need for a multidisciplinary intervention that includes nutritional counseling, physical activity, and possibly pharmacological treatment to manage BMI effectively. By addressing BMI, healthcare providers may not only mitigate the symptoms of urinary incontinence but also improve overall health outcomes for the elderly population.

Moreover, the study highlights the potential benefits of tailored exercise programs designed to reduce BMI, improve muscle strength, and enhance bladder control. Such programs could be particularly beneficial in nursing home settings, where residents can receive consistent guidance and support. Future studies should explore the specific types and intensities of exercise that are most effective for this purpose, taking into consideration the varying capabilities and health statuses of elderly individuals.

Although this study provides valuable insight into the relationship between BMI and urinary incontinence in the elderly, further research with larger samples and other variables is needed to deepen the understanding of this relationship. Future studies should investigate other potential factors that may influence urinary incontinence, such as genetic predispositions, medication use, and comorbid conditions like diabetes or hypertension. Additionally, longitudinal studies could provide more comprehensive data on how changes in BMI over time affect urinary incontinence. By expanding the scope of research to include diverse populations and settings, we can gain a more complete picture of the mechanisms behind urinary incontinence in the elderly. This could lead to the development of more personalized and effective intervention strategies.

In conclusion, this study makes an important contribution to our understanding of the factors associated with urinary incontinence in the elderly and shows the need for special attention to BMI in efforts to treat this condition. Addressing BMI through targeted interventions can play a crucial role in reducing the prevalence and severity of urinary incontinence, thereby enhancing the quality of life for elderly individuals. The findings of this research advocate for a proactive approach in managing BMI as part of comprehensive care for the elderly, emphasizing prevention, early detection, and individualized treatment plans.

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