

Differences in the Effects of Strengthening on Bosu and Activity-Based Exercises on Hallux Valgus Pain

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ABSTRACT

Introduction: Hallux valgus is a deformity of the first toe characterized by outward bending due to a valgus position at the metatarsophalangeal joint. This deformity can cause pain and interfere with daily activities, especially among working women. To determine the difference in the effects of Strengthening on bosu and Activity-Based Exercises on reducing pain caused by hallux valgus in working women in Bulakrejo Village.

Methods: This study used a quasi-experimental two-group with a pre-test and post-test design. The sample consisted of 50 subjects divided into two intervention groups with randomization. Pain was measured using the Visual Analog and Numeric Rating Scale (VANRS). Both interventions were conducted for four weeks, three times per week. Data were analyzed using the Wilcoxon test to examine the effect of each intervention and the Mann-Whitney test to compare differences between groups. **Results:** Strengthening on bosu significantly reduced pain ($p=0.001$; CI=95%) and activity-based exercise also significantly reduced pain ($p=0.001$; CI=95%) in working woman with hallux valgus. However, there was a significant difference between the groups ($p=0.014$), with a greater effect on strengthening on bosu. **Conclusion:** Both methods are effective in reducing pain, but there is a difference in impact between the two, strengthening on bosu has more effect than activity-based exercise.

Keywords: Activity-Based Exercises, Hallux Valgus Pain, Strengthening on Bosu.

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INTRODUCTION

Workers are individuals within the productive age range (15–64 years old), who have the ability to work or engage in economic activities to produce goods and services needed by society (Gultom, 2020). According to the compiled data, as of June 2020, there were 10,748 workers' unions or labor unions registered with the Directorate General of Industrial Relations and Social Security (PHI and Jamsos) in Indonesia, with a total membership reaching 3.23 million. This figure represents an increase of approximately 47.35 percent, or about 3,454 units, compared to the previous year, which recorded 7,294 units. In addition, the number of members also rose by around 19.80 percent, or 538,064 people, from 2.72 million members in June 2019. On the other hand, the number of federations increased by 11.81 percent from June 2019, reaching 161 units in June 2020. Meanwhile, the number of confederations

increased by one unit, from 15 in June 2019 to 16 in June 2020 (Kemnaker, 2020). In numerical terms, the number of female employees, based on data collected by BPS, is 17,902,976, while the number of male employees has seen a significant increase, reaching 33,045,579 (Statistik, 2022).

The use of high heels and narrow toe boxes by working women can lead to various musculoskeletal disorders that affect foot health and mobility. Common conditions include hallux valgus, which affects 23–50% of users and is characterized by a deformity of the big toe causing pain and swelling; plantar fasciitis, experienced by 10–20% of women, marked by severe pain in the sole of the foot, especially in the morning; Achilles tendinitis, affecting 5–15% of users with symptoms of pain in the Achilles tendon; osteoarthritis, which may occur in 2–10% of women and is characterized by joint pain and stiffness; and ligament injuries, experienced by 1–5% of users, marked by pain and muscle



weakness (Febriani and Rovendra, 2021).

Hallux valgus is a deformity of the first toe, characterized by a valgus position at the metatarsophalangeal joint. This deformity causes the big toe to bend outward at a certain angle compared to the other toes (Farkodjon, 2024). A meta-analysis showed that the prevalence of hallux valgus is 7.8% in children under the age of 18, 23% in adults aged 18–65 years, and 35.7% in older adults aged 65 years and above. This indicates that the prevalence of hallux valgus increases with age. Among workers, 33.3% of hallux valgus cases are found in the 17–25 age group. Meanwhile, the proportion among workers aged 26–35 years reaches 48.1% (Puri, 2020).

Several foot problems among female workers are caused by inappropriate types of shoes or footwear. Certain uniform regulations, including footwear, are required, especially in the workplace. However, these shoes can sometimes be uncomfortable if the toe box size is not suitable. Ill-fitting shoes can lead to foot issues for employees in the long term, such as hallux valgus (Soemarko *et al.*, 2020).

Strengthening exercises on a BOSU ball involve performing strengthening activities on the BOSU ball, which serve to improve blood circulation, increase metabolism, and enhance the diffusion of synovial fluid through the bone matrix. The fulfillment of cartilage nutritional needs heavily depends on the condition of the synovial fluid; therefore, the provision of nutrients to the cartilage relies greatly on its condition. Synovial fluid supplies adequate nutrients to the cartilage. Strong contractions of the abductor hallucis muscle and the muscles around the first metatarsal phalanx facilitate the pumping mechanism and ensure proper local metabolism and blood circulation. Due to vasodilation and relaxation following maximal muscle contraction, pain caused by hallux valgus can be reduced (Samosir, 2021).

Activity-Based Exercise is an exercise that causes muscle contraction, activating motor skills and muscle control. These movements maintain elasticity and stimulate the integrity of bones and joints. Therefore, good muscle elasticity and bone-to-joint integrity will reduce pain and

improve the range of motion in the first metatarsophalangeal joint (Tarbiah, 2022).

METHODS

This study used a quasi-experimental two-group test with pre-test and post-test design to examine the effects before and after the intervention of Strengthening on Bosu and Activity-Based Exercises in reducing pain caused by Hallux Valgus.

Group A	R	O ₁	X ₁	O ₂
Group B	R	O ₁	X ₂	O ₂

Note: R=random assignment to groups; O₁=pain measurement (pretest); O₂= pain measurement (posttest); X₁=strengthening on bosu; X₂=activity-based exercise

Figure 1. Two group pretest and posttest design.

The subject selection technique in this study used purposive sampling, which is a technique of selecting subjects according to research criteria. 50 subjects were selected according to the inclusion and exclusion criteria. Inclusion Criteria: Age 17-35 years, Female gender, Respondents who experience moderate hallux valgus, Respondents who experience hallux valgus pain score 4-7, Work using narrow toe box shoes, Work for long periods of 8 hours a day, Work experience 5-10 years. Exclusion Criteria: Having a history of injury or trauma, having a history of gouty arthritis, having inflammation of the ankle, having balance disorders, Pregnant women, Respondents with assistive devices. The subjects were divided into 2 groups using a randomization method using a lottery with number 1 as treatment group 1 (strengthening on bosu) and number 2 as treatment group 2 (activity-based exercise).

The measuring instrument to measure pain due to Hallux Valgus using the Visual Analog and Numeric Rating Scale (VANRS). The validity test results were 0.937 and reliability test were rho=0.937 (Andreyani and Wida, 2023). The Visual Analog and Numeric Rating Scale (VANRS) is a pain measurement tool that combines a Visual Analog Scale and a Numeric Rating Scale. It uses a syringe equipped with a face sticker, colored in various colors according to the level of pain, and equipped with a pain scale from 0 to 10, aimed at facilitating the patient's



assessment process. With this approach, subjective and objective data can be obtained to determine whether the case is included in the emergency category or not. This pain scale can be applied to a variety of cases or diagnoses, including in infants, children, adults, and the elderly, both in a conscious state and in a state of decreased consciousness. By using this tool, it is hoped that patient safety can be improved, so that health workers, patients and families can immediately know the actions that need to be taken when the patient experiences discomfort (Andreyani and Wida, 2023).



Figure 2. VANRS

The Manchester Hallux Valgus Scale is a tool for assessing the severity of hallux valgus deformity, using standardized photographs for assessment. This scale reliably describes the degree of deformity based on measurements of the hallux abduction angle, comparing photographs of the foot showing four levels of severity: none, mild, moderate, and severe (Chang et al., 2020).

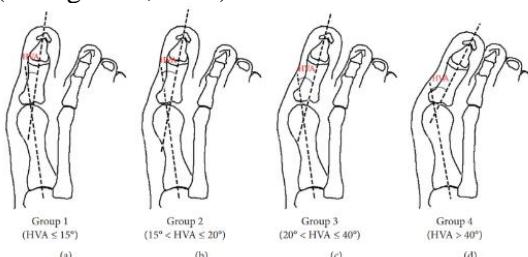


Figure 3. The Machester Hallux Valgus Scale.

Group 1, Strengthening on Bosu. The exercise is conducted over 6 weeks consisting of; 30 minutes, consisting of 5 minutes of warm-up, 20 minutes of exercise, and 5 minutes of cool down. This exercise dose is increased every 2 weeks. For the first week, exercises are done for 10 seconds, 3 sets; for weeks 3-4, 12 seconds, 3 sets; and for weeks 5-6, 15 seconds, 3 sets (Saikhanzul et al., 2022).

Group 2, Activity-Based Exercises. The exercise is conducted over 6 weeks with 30 minutes duration: 5 minutes of warm-up, 20 minutes of exercise, and 5 minutes of cooling down. This exercise dose is increased every 2 weeks. For the first week, exercises are done for 10 seconds, 3 sets; for weeks 3-4, 12 seconds, 3 sets; and for weeks 5-6, 15 seconds, 3 sets (Ozturk, 2022).

RESULTS

The results of data processing using SPSS (Statistical Product and Service Solution), to determine whether there is an effect of strengthening on the bosu and activity-based exercises on reducing pain using the Wilcoxon test are as follows:

Table 1. Effect of Intervention on Each Groups

Group	Mean	Z	Sig. (p)
Strengthening On Bosu	3.12	-4.484	0.001
Activity-Based Exercises	2.36	-4.420	0.001

Based on table 1, the VANRS significance value in the Strengthening on Bosu treatment group is 0.001 ($p<0.05$), which means that the results are influential after being given Strengthening on Bosu. And the VANRS significance value in the Activity-Based Exercises treatment group is 0.001 ($p<0.05$), which means that the results are influential after being given Activity-Based Exercises. From these results, there are similarities in significant values but the average difference is greater in the strengthening on bosu treatment.

The results of data processing using SPSS (Statistical Product and Service Solution), to determine the difference in the effect of strengthening on bosu and activity-based exercises on reducing pain using the Mann-Whitney test are as follows:

Table 2. Difference Between Groups

Group	Mean Rank	Z	Sig.(p)
Strengthening on Bosu	30.40		
Activity-Based Exercises	20.60	-2.464	0.014

The results of the Mann Whitney test showed that the VANRS value after treatment in the Strengthening on Bosu and Activity-Based Exercises categories had a p value of 0.014 ($p < 0.05$), which means there is a difference in the influence of the Strengthening on Bosu and Activity-Based Exercises categories. From these results, Strengthening on Bosu has a greater influence because the average difference is greater in the Strengthening on Bosu category treatment.

DISCUSSION

A worker is an individual who has the ability to perform work to produce goods and/or services, either to meet personal needs or for the community. According to the Big Indonesian Dictionary (KBBI), a worker is someone who works or performs a job, such as a laborer, employee, and so on. Generally, a worker can also be defined as someone who has the ability to perform work, whether in formal or informal employment relationships (Trixie et al., 2023).

The productive age group is the population aged 15 to 64 and considered able to work. This group comprises approximately 66.5% of Indonesia's total population. Meanwhile, the non-productive age group comprises approximately 27.3% of the population aged 0-14, and approximately 6.1% of those aged 64 and above, comprising children and the elderly (Marlia et al., 2022).

Hallux valgus is a deformity of the forefoot in which the metatarsal joint (MTPJ) deviates outward and the first metatarsal bone deviates inward. This condition causes foot pain and difficulty wearing shoes, impacting daily life, reducing mobility, increasing the risk of falls, and affecting balance Chadchavalpanichaya et al., (in Zahra and Fathi, 2024).

Pathophysiology of hallux valgus: When the first metatarsal head separates from the sesamoid apparatus, the muscular forces acting on it cause pronation. Normally, the abductor hallucis tendon provides excellent support to the proximal phalanx of hallux valgus, but this function is impaired by inefficient rotation of its medial and plantar attachments. Because the adductor hallucis tendon attaches to the sole of the foot, it tends to pull the phalanx toward pronation, causing dislocation of the base of the phalanx. The weakened metatarsophalangeal joint capsule is not reinforced by tendons and therefore rotates medially during pronation, causing significant instability. By moving the metatarsal head medially and lifting it, plantar pressure can be diverted outward. Thus, hallux valgus is essentially a valgus subluxation of the two phalanges of the big toe (Cavalheiro and Guil, 2020).

CONCLUSION

Based on the results of research conducted on 50 respondents, it can be concluded that the results of the influence test with the Wilcoxon test showed an influence in group 1 with the Strengthening on Bosu intervention with a VANRS value of $p=0.001$, an influence in group 2 with the Activity-Based Exercises intervention with a VANRS value of $p=0.001$. From these results, there are similarities in significant values but the average difference is greater in the strengthening on bosu treatment, and there is a difference in influence tested using the Mann-Whitney test between group 1 and group 2, there is a significant average value using VANRS $p=0.014$.

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