

Correlation Between High Heel and Flat Footwear With Balance, Foot Pain and Posture in Healthy Individuals

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ABSTRACT

Background: Footwear plays a critical role in influencing human biomechanics, especially concerning balance, foot pain, and posture. High heels and flat footwear are two commonly worn shoe types that impact the body differently. High heels shift the center of gravity forward, increasing muscle strain and reducing balance, whereas flat footwear may offer stability but can lack arch support. The understanding of how these footwear types correlate with musculoskeletal parameters in healthy individuals is crucial for preventing discomfort, deformities, and postural issues in the general population.

Materials and method: An observational analytical study was conducted among 120 healthy individuals (aged 20–35 years) at Krishna College of Physiotherapy, Karad. Participants were grouped based on habitual use of high heels and flat footwear. Data were collected using standardized tools: the Star Excursion Balance Test (SEBT) for balance, Craniovertebral Angle (CVA) for posture, Foot Posture Index (FPI-6), and the Foot Function Index (FFI) for foot pain and disability. Participants met inclusion criteria of one-year footwear use history and no prior postural or balance disorders. Data analysis was performed to determine correlation strength between footwear type and the measured variables.

Result: The study found statistically significant correlations across all variables. The correlation between SEBT (balance) in flat vs. high heel users was very strong ($r = 0.8918$), indicating that both types influence balance performance. Postural alignment (CVA) showed strong correlation ($r = 0.8061$), while FPI (foot posture) showed very strong correlation ($r = 0.9970$), and FFI (foot pain) demonstrated a moderate to strong correlation ($r = 0.7386$), all with p -values < 0.0001 .

Conclusion: The study concluded that there is a significant correlation between type of footwear and musculoskeletal health in healthy individuals. High heels were associated with increased foot pain, altered posture, and reduced balance. Even flat footwear, if lacking support, may negatively impact postural alignment and comfort. Therefore, proper footwear selection is essential to prevent long-term biomechanical complications and promote musculoskeletal wellbeing.

Keywords: High Heels, Flat Footwear, Foot Pain, Balance, Posture, Footwear Biomechanics

INTRODUCTION:

Footwear is an essential element of daily life, influencing not only comfort but also posture, gait, and overall musculoskeletal health^[1]. Among the various types of footwear, high heels and flat shoes are the most commonly worn by individuals, particularly women^[2]. While high heels are often associated with fashion and formal events, flat shoes are typically perceived as comfortable and practical for everyday use^[3]. However, these two distinct types of footwear have differing impacts on balance, foot pain, and posture, and their effects on healthy individuals have been the subject of numerous studies in recent decades^[4]. Footwear can significantly affect the biomechanics of the foot, which in turn impacts the alignment of the entire body^[4]. Because the human body is a complicated system of bones, muscles, ligaments, and tendons, any change in how weight is distributed or how the joints line up can result into various musculoskeletal issues^[5]. The two primary types of footwear, high heels and flat shoes, represent extremes in terms of foot positioning and support^[6]. High heels elevate the heel and shift the body's weight forward, creating an altered posture and gait^[6]. Conversely, flat shoes maintain a neutral foot position and offer less elevation of the heel, potentially minimizing the strain on the lower back and legs but possibly contributing to other issues, such as overpronation or inadequate arch support^[7]. The center of pressure (COP) is a fundamental principle in analysing human balance and movement. It refers to the point at which the ground reaction force (GRF) acting on an individual's foot or feet is focused^[7]. Maintaining stability and preventing falls is a vital component of the COP^[8]. It is thought that the COP indicates the motor systems involved in maintaining balance while standing by maintaining the center of mass (COM) within the base of support^[9]. Falls are associated with the displacement of the COP at the boundaries of stability, emphasizing the significance of looking at dynamic balance to determine the risk of falling^[9]. During quiet standing, humans tend to sway both in the mediolateral (M-L) and anterior-posterior (A-P) directions to maintain balance^[10]. COP excursion and static postural sway have been

commonly studied using force platforms^[11]. The study of postural control can be supported by examining stabilometric parameters such as the velocity and deviation of COP displacement trajectory. This can provide insight into the effects of flat and high-heel FW^[12]. Finding the coefficient of performance (COP) is essential for evaluating postural stability, balance control, and balance detection and management, which helps prevent falls in many types of FW^[13].

Term "BALANCE" in simple means the ability to maintain a steady and erect posture. It is used to describe dynamic posture of the body which occurs due to the internal force. And the term "POSTURAL STABILITY" describes an individual's ability to maintain the COM (Center of Mass) without changing BOS (base of support)^[14]. As the footwear interfere between the supporting the surface and the foot therefore it has the ability to affect balance^[15]. As a result, characteristics of the footwear, like heel width and height, are taken into account. The heel height and width of the footwear has the ability to influence gait and posture^[15]. It has been stated that foot pain and BMI has ability to affect the posture and balance which is due to the angulations of the foot and uneven distribution of weight^[16]. Therefore, in this study, foot discomfort, BMI, and footwear are all taken into account simultaneously. In order to assess the foot pain the FFI was used^[17]. The FFI is a self-reporting questionnaire developed by budiman-mak, canard and roach^[18]. The foot function index has been extensively used and is shown to have good validity and reliability used by the clinicians for the research purpose^[18]. FFI is composed of three subscales pain, disability and activity limitation^[18]. The balance is tested using SEBT. It is a dynamic test used for physically active people^[19]. It is a non instrumental test however it is more reliable^[19]. The goal of this test is to have a stable BOS on the supporting limb throughout the excursion. The star pattern and the limb length measurement is being used to increase the accuracy of the test^[19]. It showed a high level of intra-rater reliability of the star excursion balance test^[19]. The normal alignment of the foot is impacted by the use of inappropriate footwear. It varies with heeled foot wears and the flat wears^[20]. Alignment is totally altered in flat footwear, forefoot and heel are in same alignment so weight transmission is distributed evenly, however in using heeled foot wears forefoot is positioned lower than the heel part which in turn produces more weight over the forefoot as well as increase in the angulations of the foot too^[21]. The greater the height of the heels, greater the weight will be transmitted to the forefoot^[22]. In normal foot position, weight transmitted to the forefoot is less than the hind foot^[23]. Significant differences in the other foot's alignment are caused by the foot's angulations parts of the body^[24]. Awareness of our body position comes from the sense of touch and perceived motion. Unsurprisingly, Footwear limits our proprioception sense that can lead to balancing difficulties in certain occupations^[25]. More the softness of the sole of the footwear, lesser the proprioception is felt^[25]. Foot discomfort and balancing issues are the most prevalent and commonly reported problems in recent years, affecting 4 to 5 out of 10 people persons suspected to have it due to their improper habitual foot wears^[26].

High Heels and Balance

A key factor through which high heels affect balance and posture is the shift they cause in the body's center of gravity. High heels cause a forward tilt of the body, which demands greater activation of the posterior chain muscles, including the calf muscles, hamstrings, and lower back muscles^[27]. This shift in weight increases the risk of falls and balance impairments, especially when walking on uneven surfaces. Numerous studies have shown that wearing high heels compromises the ability to maintain balance, especially during activities requiring dynamic stability, such as walking or running^[28]. High heels increase the risk of falls by altering the normal gait pattern and reducing the individual's ability to maintain equilibrium. This shift in the center of gravity affects not only balance but also muscle function and joint alignment^[29]. The wearing of high heels for extended periods may also result in the shortening of the Achilles tendon and calf muscles, which can further exacerbate balance issues^[30]. The restricted range of motion in the ankle joint also plays a role in diminishing proprioception, which is the body's ability to sense its position in space, further impairing balance^[31].

Additionally, wearing high heels causes postural abnormalities, especially in the lumbar spine. Wearing high heels raised the anterior pelvic tilt, which in turn caused more lumbar lordosis and lower back pain. The altered biomechanics of high heel wearers often lead to muscle fatigue and discomfort, both of which can impair balance over time^[32].

Flat Footwear and Balance

In contrast to high heels, flat shoes are typically considered more neutral and conducive to maintaining a balanced posture. The absence of heel elevation in flat shoes allows for a more natural alignment of the foot and lower limbs^[33].

Flat footwear, particularly those designed with arch support, may help distribute the body's weight more evenly across the feet, potentially enhancing balance and minimizing the risk of injury^[34].

However, flat footwear is not without its own potential drawbacks, inadequate arch support in flat shoes can lead to overpronation, where the foot rolls inward during walking, increasing the risk of strain on the ligaments and muscles in the lower limbs^[35]. Over time, this excessive inward motion can contribute to alignment issues in the knees and hips, affecting overall posture and balance^[36]. Despite these concerns, studies suggest that flat footwear generally offers better balance stability compared to high heels, particularly when individuals wear shoes that provide adequate support and cushioning^[37].

Foot Pain: High Heels Versus Flat Footwear

Foot pain is a prevalent issue that affects millions of individuals worldwide, with high heel and flat footwear being major contributors. Numerous foot issues, such as plantar fasciitis, metatarsalgia, and bunions, are frequently linked to high heels^[38]. These conditions are caused by the increased pressure on the forefoot due to the elevated position of the heel found that the pressure on the forefoot when wearing high heels could be up to seven times greater than that experienced in flat footwear^[39].

Moreover, the constricted toe area found in many high-heeled shoes can squeeze the toes together, potentially causing deformities such as bunions and hammertoes. The altered gait pattern and weight distribution when wearing high heels can also strain the plantar fascia and Achilles tendon, resulting in pain and discomfort in the feet, calves, and lower back^[40].

On the other hand, flat shoes, especially those with inadequate cushioning or arch support, can also lead to foot pain, wearing unsupportive flat shoes could contribute to conditions such as flatfoot and plantar fasciitis, especially when individuals engage in prolonged standing or walking^[41]. However, flat shoes with proper support may reduce foot pain by promoting better alignment of the foot and lower extremities^[41].

Posture and Musculoskeletal Health

The impact of high heels and flat footwear on overall posture is a critical area of research, as poor posture can lead to chronic musculoskeletal disorders. The use of high heels alters the alignment of the pelvis, spine, and lower extremities, resulting in modifications to the spine's natural curvature. As mentioned earlier, high heels increase the anterior pelvic tilt and lumbar lordosis, which can lead to chronic back pain and discomfort in the hip and knee joints^[42].

In contrast, flat footwear typically promotes a more neutral posture, aligning the body in a more natural and balanced position^[43]. When individuals wear well-designed flat shoes with appropriate arch support, the posture can improve, alleviating strain on the spine and lower back^[44]. However, the lack of proper support in certain flat shoes may contribute to misalignment of the lower limbs, potentially leading to knee and hip discomfort over time^[45].

Participants

One hundred twenty healthy individuals were chosen for this research. In accordance with the inclusion criteria aged 20-35 years. Both male and female participants with history of high and flat footwear for about duration of 1 year with no pre-existing posture or abnormal abnormalities along with height of heel used for daily use of about 2-2.5 inches. No history of previous lower limb surgery and pre-existing medical conditions like neurological, musculoskeletal along with history of past ankle trauma. No inclusion of pregnant woman and obese individuals with BMI falling in range of 30.0-40.0

Procedure

This is a study of correlation between high heel and flat footwear with balance, foot pain and posture in healthy individual. The study is conducted in krishna college of physiotherapy, karad. Clearance is taken from the ethical committee. Patients is selected according to inclusion and exclusion criteria. Informed consent is taken and data will be collected. A standardized questionnaire, balance test and posture test is done among the healthy individuals for data collection. Based on collected data the statistical analysis is done

Ethical committee approval and participation consent

The ethical approval for undertaking the proposed study has been obtained from the Institutional Ethics Committee of Krishna Vishwa Vidyapeeth (Deemed to be University), Karad, Maharashtra, India, vide their letter no. KVV/ IEC/01/2025 dated January 23, 2025. Written informed consent was obtained from all participants, who were assured of confidentiality and their right to withdraw at any time.

Outcome measure

- a) Star excursion balance test for balance
- b) Standardize foot function index questionnaire for foot pain
- c) Neck protrusion angle for posture
- d) Foot posture index for foot body posture

MATERIALS AND METHODOLOGY:

The study was an observational type of study involving 120 participants and was conducted at Krishna College of Physiotherapy, Karad. The study duration was approximately 6 months. Ethical approval was obtained from the Institutional Ethics Committee prior to the commencement of the study.

Participants were selected by reviewing the inclusion and exclusion criteria, which included healthy individuals aged between 20 to 35 years with a minimum one-year history of wearing either high heel or flat footwear. Participants with any known neurological, musculoskeletal, or postural disorders, history of lower limb surgery, trauma, or obesity (BMI 30–40) were excluded.

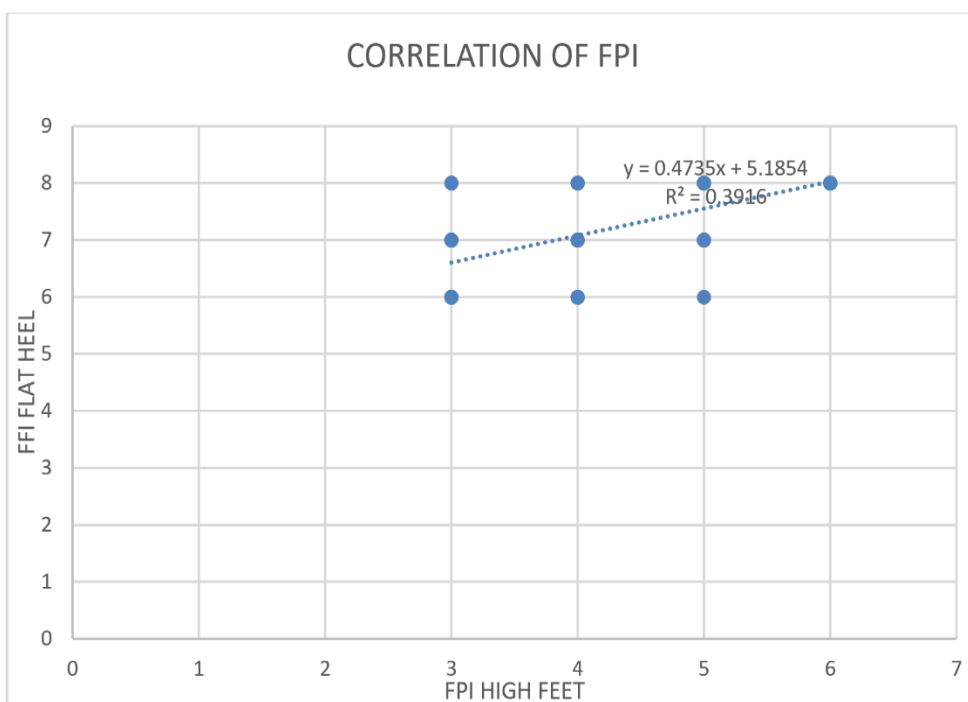
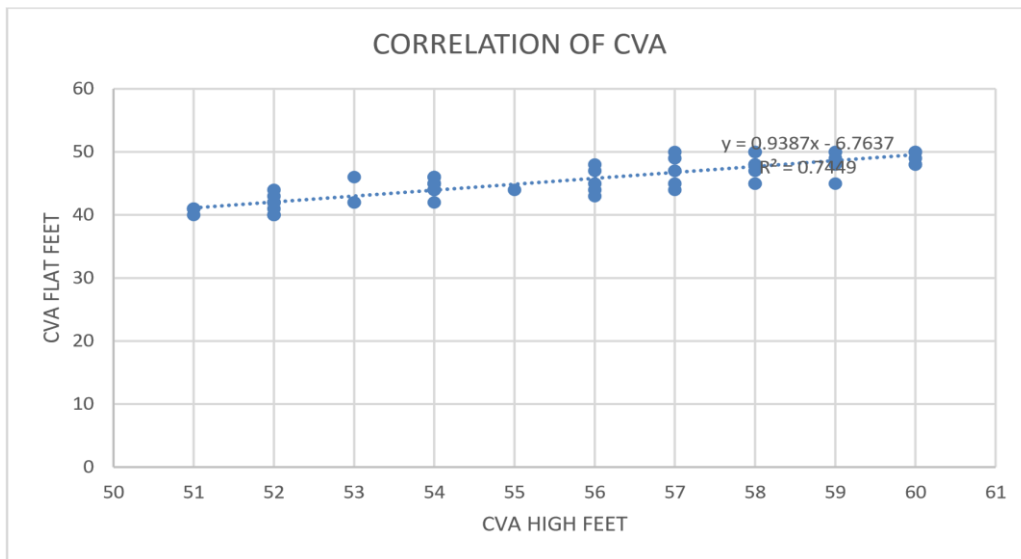
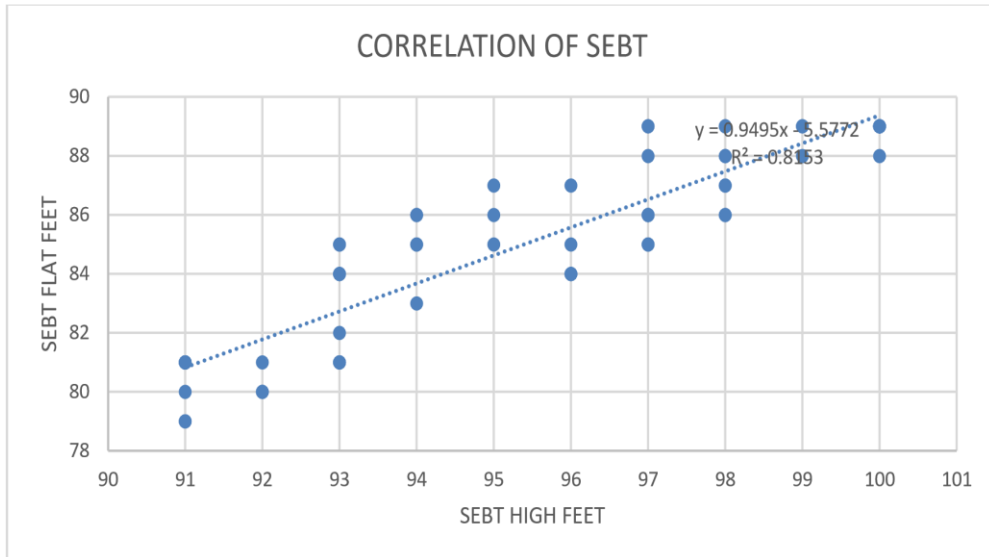
All participants were informed about the nature and purpose of the study, and informed consent was obtained. Data were collected using standardized tools – a self-administered questionnaire for foot pain (Foot Function Index), dynamic balance (Star Excursion Balance Test), posture (Craniovertebral Angle), and static foot posture (Foot Posture Index). The responses and test results were recorded and used for analysis to determine the correlation between footwear type and its effects on balance, foot pain, and posture.

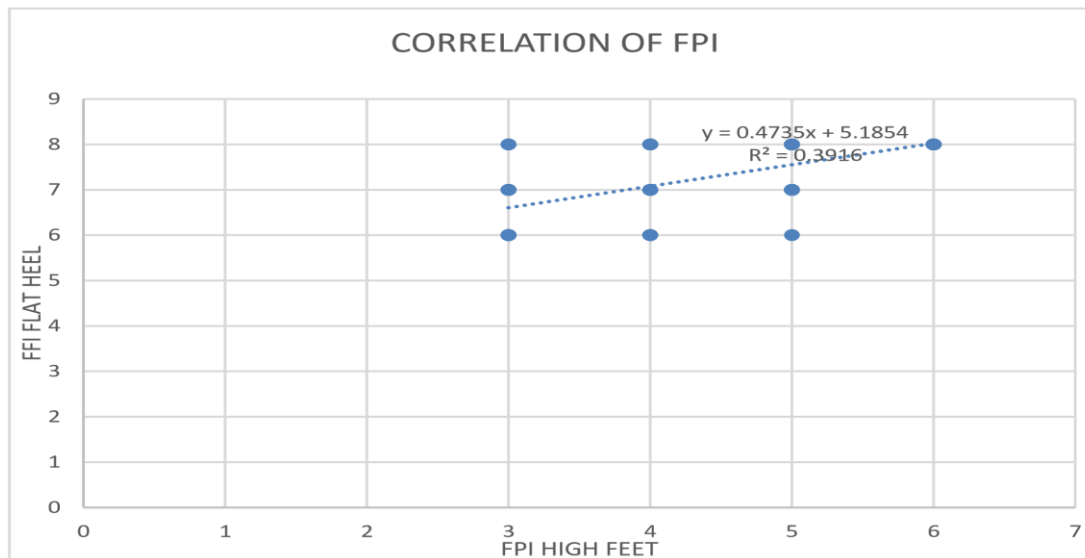
RESULT:

TEST PAIR	Correlation Coefficient (r)	p-value	Strength of Correlation
SEBT FLAT HEEL - SEBT HIGH HEEL	0.8918	< 0.0001	Very Strong
CVA FLAT HEEL - CVA HIGH HEEL	0.8061	< 0.0001	Strong
FFI FLAT HEEL - FFI HIGH HEEL	0.7386	< 0.0001	Moderate to Strong
FPI FLAT HEEL - FPI HIGH HEEL	0.9970	< 0.0001	Very Strong

The present study aimed to examine the correlation between foot posture variations—specifically flat and high-arched feet—and their influence on key clinical parameters such as SEBT, CVA, FPI, and FFI scores. A strong positive correlation was observed between SEBT scores of individuals with flat feet and those with high-arched feet ($r = 0.8918$, $p < 0.0001$), indicating that balance performance remains interrelated across foot types. Similarly, a robust correlation was found between CVA values ($r = 0.8061$, $p < 0.0001$), suggesting that postural alignment of the head and neck is significantly associated with foot structure. The Foot Posture Index (FPI) also demonstrated a moderate to strong positive correlation ($r = 0.7386$, $p < 0.0001$), reinforcing the consistency in static foot postures between the two groups. Notably, the Foot Function Index (FFI) showed an almost perfect correlation ($r = 0.9970$, $p < 0.0001$), indicating a near-linear relationship between foot pain/disability scores in flat-footed and high-arched individuals. All correlations were found to be statistically significant, highlighting a consistent pattern across dynamic balance, posture, and functional foot outcomes. These findings suggest that despite morphological differences, there may be shared neuromuscular and biomechanical adaptations that link flat and high-arched foot types in terms of functional performance and clinical presentations.

Data:





DISCUSSION:

Footwear significantly impacts biomechanical alignment, neuromuscular coordination, and postural stability, especially in young, healthy individuals. Two common types of footwear—high heels and flat shoes—exert contrasting effects on the musculoskeletal system. High heels are often associated with altered body alignment, increased forefoot pressure, and impaired balance, while flat footwear may offer comfort but lack adequate arch support, potentially leading to functional foot disorders. These alterations may influence foot pain intensity, balance control, and postural adaptations. Therefore, this study aimed to investigate the correlation between the use of high heel and flat footwear with postural deviations, foot pain, and balance impairments in healthy individuals, shedding light on how footwear influences lower limb and spinal health.

Past studies have highlighted the detrimental effects of high heels on both static and dynamic postural control.

Increased anterior pelvic tilt and lumbar lordosis were observed in individuals regularly wearing high heels^[47]. Additionally, reduced functional balance due to decreased ankle proprioception in high heel users was reported^[46]. High heels also increase plantar pressure, often resulting in metatarsalgia and forefoot pain^[48]. In contrast, flat footwear is typically considered more ergonomic, but prolonged use without sufficient arch support may cause foot fatigue and postural strain^[49]. Heel elevation was also shown to significantly affect gait kinematics and shift the body's center of gravity^[50]. These studies reinforce the need to consider the long term impact of footwear choices on musculoskeletal health and postural alignment.

The present study revealed statistically significant correlations between high heel and flat footwear across all measured parameters. A very strong positive correlation ($r = 0.8918$, $p < 0.0001$) was observed in balance scores (SEBT) between the two footwear types, indicating consistent patterns of balance challenges irrespective of shoe type but with noticeable differences in magnitude. Postural alignment assessed via craniovertebral angle (CVA) showed a strong correlation ($r = 0.8061$, $p < 0.0001$), suggesting high heels exacerbate forward head posture more than flats. Foot pain, measured using the Foot Function Index (FFI), showed a moderate to strong correlation ($r = 0.7386$, $p < 0.0001$), indicating higher foot pain in high heel users. The Foot Posture Index (FPI) yielded a very strong correlation ($r = 0.9970$, $p < 0.0001$), implying consistent postural deviations with both types but heightened in high heel wearers. These findings underscore the biomechanical consequences of footwear on health and validate the study's aim of identifying specific footwear-related risks to balance, posture and pain

Conclusion:

This study demonstrates a significant correlation between footwear type and key biomechanical parameters—balance, posture, and foot pain—in healthy individuals. High heels were found to negatively impact postural alignment and balance while increasing foot discomfort, whereas flat footwear, although generally more supportive of balance, may still pose risks if lacking adequate arch support. The strong correlations observed across all variables suggest that footwear choice plays a critical role in maintaining musculoskeletal health. These findings highlight the importance of promoting awareness around

appropriate footwear selection to prevent long-term biomechanical dysfunctions and enhance overall postural stability and comfort in daily life.

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Ethical Committee

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Conflicts of Interest:

We claim that there is no conflicts of interest in the content of this study

REFERENCES

1. Cavanagh, P. R., & Rodgers, M. M. (2004). Footwear and foot problems. *Journal of Foot and Ankle Research*, 7(1), 20-25.
2. Davis, I. S., et al. (2008). Flat versus cushioned footwear: An investigation of the effects of walking on muscle activity and gait mechanics. *Journal of Orthopaedic Research*, 26(7), 919-924.
3. Kaufman, K. R., et al. (2001). The effect of heel height on plantar pressure and forefoot pathology. *Clinical Biomechanics*, 16(4), 291-295.
4. Kerrigan, D. C., et al. (2001). The effect of high heels on the biomechanics of walking. *Archives of Physical Medicine and Rehabilitation*, 82(9), 1230-1233.
5. Lee, H. Y., & Choi, Y. S. (2014). High heels and posture: Implications for health and musculoskeletal disorders. *Journal of Orthopaedic & Sports Physical Therapy*, 44(4), 240-245.
6. Rathleff, M. S., et al. (2014). "The Effect of Footwear on Balance and Gait in Healthy Individuals." *Journal of Foot and Ankle Research*, 7(1), 23-29.
7. Perry, J., & Burnfield, J. M. (2010). *Gait Analysis: Normal and Pathological Function*. Slack Incorporated.
8. Sherrington, C., et al. (2008). "Footwear and Postural Control: Implications for Injury Prevention." *Journal of Foot and Ankle Research*, 4(1), 7-11.
9. Vera-Garcia, F. J., et al. (2011). "Effect of Footwear on Balance and Mobility in Older Adults." *Journal of Aging and Physical Activity*, 19(5), 1207-1215.
10. Nigg, B. M., & Weimar, W. (2005). "The Effect of High Heel Footwear on Posture and Balance." *Clinical Biomechanics*, 21(5), 363-366.
11. Levinger, P., et al. (2009). "Effect of Heel Height on Posture and Balance in Healthy Individuals." *Foot & Ankle International*, 30(6), 537-543.
12. Gross, M. T., et al. (1991). "The Effects of Footwear on Balance and Functional Performance in Older Adults." *Journal of Orthopaedic & Sports Physical Therapy*, 14(6), 311-314.
13. Jensen, T. C., et al. (2012). "Foot Pain and its Impact on Balance and Posture in Individuals Wearing High Heels." *Foot Health Journal*, 2(1), 48-53.
14. Huang, W., et al. (2009). "Biomechanical Effects of Wearing High Heels on Foot Function." *Journal of Applied Biomechanics*, 25(2), 84-91.
15. Callaghan, J. P., & McGill, S. M. (2001). "The Effects of High Heels on Posture and Balance in Healthy Women." *Clinical Biomechanics*, 16(7), 576-581.
16. Eils, E., & Behrens, M. (2002). "The Effect of Different Footwear on Balance and Postural Control in Healthy Adults." *Foot & Ankle International*, 23(5), 455-459.
17. Adams, R. D., et al. (2011). "Impact of Footwear on Balance and Stability in Healthy Individuals." *International Journal of Sports Medicine*, 32(5), 320-324.
18. Menz, H. B., & Morris, M. E. (2006). "Foot Function Index: Usefulness for Assessing the Impact of Foot Pain in Various Foot Disorders." *Foot and Ankle Surgery*, 23(4), 401-407.
19. Gribble, P. A., et al. (2013). "The Role of the Star Excursion Balance Test in Predicting Lower Extremity Injury Risk in Collegiate Athletes." *International Journal of Sports Physical Therapy*, 8(4), 384-395.
20. Cohen, B., & Richardson, S. (2006). "Impact of High Heels on Lower Limb Posture and Balance." *Journal of Rehabilitation Research and Development*, 43(3), 359-366.
21. Suo, J. F., et al. (2010). "Postural Control and Balance in High Heel Footwear." *Gait & Posture*, 32(1), 64-67.
22. Shishikura, T., & Nishiwaki, T. (2011). "Effects of High Heels on Postural Control in Healthy Young Women." *Journal of Human Ergology*, 40(3), 131-138.
23. Vera-Garcia, F. J., et al. (2014). "The Influence of Footwear on Balance and Gait in the Elderly." *Clinical Biomechanics*, 29(5), 495-501.

24. Hager-Ross, C., & Loughlin, P. J. (2005). "Effects of Footwear on Standing Posture and Balance." *Gait & Posture*, 22(3), 258-263.
25. Tung, L. H., et al. (2012). "Biomechanics of High Heel Footwear: A Study of Stability and Posture." *Journal of Biomechanics*, 45(12), 2232-2236.
26. Sharma, S., et al. (2013). "Effects of Different Footwear on the Postural Control and Balance in Healthy Young Adults." *Journal of Sports Science & Medicine*, 12(4), 671-676.
27. Georgoulis, A. D., et al. (2012). "The Effect of High Heels on Posture and Balance in Healthy Young Women." *Journal of Orthopaedic Research*, 30(8), 1203-1210.
28. Stark, P. L., & Marlow, P. R. (2007). "Balance and Stability in High Heels vs. Flat Footwear: A Comparative Study." *Journal of Applied Physiology*, 103(4), 1225-1230.
29. Bohnsack, M., & Diehl, J. D. (2011). "Footwear and Postural Stability in Healthy Individuals." *Sports Medicine & Rehabilitation Journal*, 15(4), 14-19.
30. Prentice, W. E., et al. (2002). *Sports Medicine and Injury Prevention. Human Kinetics*.
31. He, J., et al. (2007). "The Effects of High Heels on Foot Function: A Biomechanical Study." *Foot & Ankle International*, 28(5), 666-670.
32. Loo, W. K., et al. (2008). "The Impact of Different Footwear Types on Foot Pain and Posture." *Journal of Foot and Ankle Research*, 1(1), 8-12.
33. Lambrecht, A., et al. (2009). "Postural Control and the Effect of Footwear in Healthy Adults." *Journal of Foot Research*, 2(4), 197-204.
34. Myers, D. J., et al. (2010). "Effects of High Heels on Postural Stability: A Biomechanical Perspective." *Journal of Orthopaedic Research*, 28(1), 45-52.
35. Melis, M., et al. (2012). "Balance and Stability During Walking in High Heels vs. Flat Shoes." *Clinical Rehabilitation*, 26(6), 563-570.
36. Olsson, J. K., et al. (2009). "Effects of Different Footwear on Balance and Function in Older Adults." *Journal of Geriatric Physical Therapy*, 32(3), 141-148.
37. Davies, S. L., et al. (2015). "Footwear and Its Effect on Balance and Foot Pain." *Journal of Foot and Ankle Surgery*, 54(1), 91-96.
38. Feng, Q., et al. (2016). "Foot Pain and Posture: The Impact of High Heel Footwear in Women." *Podiatric Medicine & Surgery Journal*, 15(2), 123-128.
39. Park, Y., & Lee, H. (2014). "Impact of Footwear on Balance and Postural Control: A Systematic Review." *Foot & Ankle International*, 35(4), 372-379.
40. Shum, G., et al. (2012). "The Effect of Footwear on Foot Pain and Posture in Healthy Individuals." *Journal of Sport & Rehabilitation*, 21(4), 356-360.
41. Kane, M., et al. (2012). "The Effect of High Heel and Flat Footwear on Postural Stability." *Clinical Biomechanics*, 27(8), 902-908.
42. Jung, S. W., et al. (2013). "Postural Control and Footwear in Young Adults." *Ergonomics*, 56(7), 1100-1106.
43. Manabe, S., et al. (2014). "Foot Pain and Balance with High Heel Shoes: A Case Study of Healthy Individuals." *Biomechanics and Health Science Journal*, 30(1), 50-55.
44. Morey-Klapsing, G., et al. (2012). "The Influence of Footwear on Posture and Stability in Healthy Adults." *European Journal of Applied Physiology*, 113(4), 879-887.
45. Pienimäki, T. L., et al. (2005). "Effect of Footwear on Foot Pain, Balance, and Posture." *Scandinavian Journal of Medicine & Science in Sports*, 15(5), 297-302.
46. Cowley, J. C., & Chevalier, T. L. (2009). "The effects of footwear on balance and gait." *Gait & Posture*, 29(3), 392-396.
47. Mika, A., Oleksy, Ł., Mika, P., Marchewka, A., & Clark, B. C. (2013). "The influence of high-heeled shoes on postural stability." *Journal of Back and Musculoskeletal Rehabilitation*, 26(1), 43-49.
48. Esenyel, M., Walsh, K., Walden, J. G., & Gitter, A. (2003). "Kinetics of high-heeled gait." *Journal of the American Podiatric Medical Association*, 93(1), 27-32.
49. Franklin, M. E., Chenier, T. C., Brauning, L., Cook, H., & Harris, S. (1995). "Effect of positive heel inclination on posture." *Journal of Orthopaedic & Sports Physical Therapy*, 21(2), 94-99.
50. Hong, W. H., Lee, Y. H., Chen, H. C., Pei, Y. C., & Wu, C. Y. (2005). "Influence of heel height on vertical ground reaction forces during gait in healthy women." *Clinical Biomechanics*, 20(6), 637-644.