INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH AND ANALYSIS

ISSN(print): 2643-9840, ISSN(online): 2643-9875

Volume 05 Issue 10 October 2022

DOI: 10.47191/ijmra/v5-i10-07, Impact Factor: 6.261

Page No. 2607-2612

Impact of Shoes Characteristics to Lower Back Pain in Orthotics Prosthetics Students in Jakarta

Deby Eka Supadma[1], **Nabila Alya Azzahra**[2], **Agusni Karma**[3], **Tri Riana Lestari**[4], **Rina Fitriana Rahmawati**[5]

[1,2,3,4,5]Prosthetics Orthotics Department, Health Polytechnic of Jakarta I, Indonesia

ABSTRACT: Standing for more than 20 minutes causes' low back pain (LBP). Students majoring in prosthetics orthotics need to practice and stand for more than 2 hours per day. Long standing requirement is un-avoided in students, causing musculoskeletal disorder such as low back pain. The characteristics of shoes are important in development and treatment of lower back conditions. Shoes have several features, which play important roles in posture stability. Usage of shoes with certain characteristics may contributes to low back pain in students.

Objective: To determine relationship between shoes characteristics and standing duration on low back pain in orthotic prosthetics students.

Method: Correlational quantitative method with cross-sectional design. Purposive sampling used in order to obtain sample of 30 people. Independent variables are the suitability of the shoes used, firmness of shoes soles, *heel counter of shoes*, and standing duration. Dependent variable is low back pain.

Result: The relationship between the suitability of the shoes used and low back pain obtained p value of 0.141. Relationship between firmness of shoes sole and low back pain obtained p value of 0.355. Relationship between shoes *heel counter* and low back pain obtained p value of 0.948. Relationship between standing duration and low back pain obtained p value of 0.01. Conclusion: Appropriate of shoes used, firmness of shoes soles, heel counter of shoes, do not have significant relationship with the LBP. Standing duration has significant relationship with LBP.

Conclusion : Appropriate of shoes used, firmness of shoes soles, heel counter of shoes, do not have significant relationship with the LBP. Standing duration has significant relationship with LBP.

KEYWORDS: Low Back Pain, Shoes Characteristics, orthotics prosthetics

I. INTRODUCTION

Effectiveness of standing at work causes workers to perform this position for long period of time [17]. Despite of its productivity, standing can cause loss of movement in back, increased load on the tissues and leads to pain [14]. Standing for more than 4 hours a day increased lower back pain by 100% [2, 18]. Standing for more than 20 minutes will slowly reduce tissue elasticity, increases muscle pressure and causes discomfort in lower back area [35].

Low back pain (LBP) is clinical syndrome characterized by pain or unpleasant feeling in lower back area. It may be experienced as a pain, burning, stabbing, sharp or dull, or vague, ranging in intensity from mild to severe. The exact incidence of low back pain in Indonesia is unknown, estimated varies between 7.6% to 37% [36].

Students majoring in orthotic prosthetics need to implement their knowledge in practical session based on prosthetics/orthotics course. Standing time spent during practical session may varies among courses, but it takes more than 4 hours per day. For example, standing time to perform rectification of prosthesis/orthosis, fabrication of devices, and fitting process with model patient. Long standing requirement is un-avoided in students, causing musculoskeletal disorder such as low back pain.

A pair of shoes causes changes in standing posture, as well as changes in force and movement. The shoes are the only connection between body and ground during standing. Changing shoes may change standing posture and whole alignment of entire body [6].The characteristics of shoes are important in development and treatment of various foot, lower limb, and lower back conditions [8]. Shoes have several features which play important roles in posture stability [30]. In addition, shoes are useful for providing weight support and additional shock absorption for the wearer [11].

Shoes with firm heel counter can control neutral position of heel, prevent it from collapsing to medial side [34]. Shoes can protect user from foot pronation, thus provide better balance and prevent low back pain [22]. Assessment of shoe characteristics can be done with Footwear Suitability Scale instrument [26]. This assessment determines how many characteristics of shoes are in accordance with the user's feet. Assessment of these characteristics are important to ensure that usage of shoes do not cause problems with the feet or back [8, 37].Shoes used by students at Department of Prosthetics Orthotic during practical session are diverse. Commonly it is a pair of sneakers or sport shoes.The purpose of this study is to investigate relationship between shoe characteristics, standing duration, and lower back pain in students at Orthotic Prosthetic Department, polytechnique of health science of Jakarta I,Indonesia. Human research ethics committee of Health Polytechnic of Jakarta I approved study protocol, all participants taking part in the study given informed consent.

II. METHOD AND MATERIAL

Correlational quantitative method with cross-sectional design was used for this investigation. Population in this study were students of Department of Prosthetic Orthotics, polytechnique of health science of Jakarta I, used purposive sampling method for participant sampling. The inclusion of this study were students of the Department of Orthotic Prosthetics, experienced at least 1 hours standing per day and experienced low back pain. Exclusion criteria are student with history of trauma, disease, or spine abnormalities.

Questionnaire contains Visual Analogue Scale (VAS) was used to describe level of low back pain. Participant's standing duration was asked. The Footwear Suitability Scale was used as a tool for measuring shoes characteristics of participants. It contains of suitability of shoes, firmness of soles, and heel counter features. SPSS v.25 for Windows was used to analyze the data. Bivariate data analysis used Kendall's tau-b test used to test relationship between two variables.

III. RESULT

Table I summarizes participants' characteristics with highest age frequency of 20 years (66.7%), followed with 33.3% participant with 21 years old of age. By gender, 20 participants were female and 10 participants were male. There were 16 participants has normal body mass index/ BMI (53.3%), 7 participants (23.3%) in obese category, and 5 participants (16.7%), in thin category and 2 participants (6.7 %) in fat category.

In shoes characteristic, 12 participants wear quite appropriate shoes (40%), 11 participants wear appropriate shoes (36.7%), 7 participants wear quite appropriate shoes. In standing duration carried out by participants, the numbers are diverse. 12 participants (40%) stand for less than 2 hours per day, 9 participants (30%) stand 2-4 hour per day, 9 participants (30%) stand for more than 4 hour per day. **Figure 1** shows Lower Back pain scale experienced by participants. 14 participants (46.7%) have mild LBP, 9 participants (30%) have moderate LBP, and 7 participants (23.3%) have severe LBP.

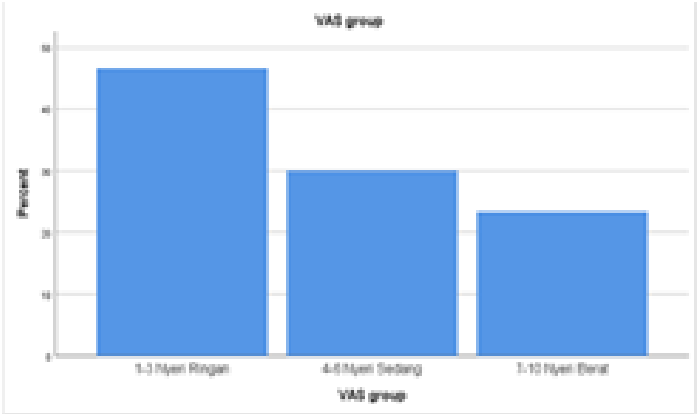

Figure 1 Bar Chart of LBP pain scale

Table 1. Participants' characteristics

Demographic	N	%
Age		
≤ 20 years old	20	66.7%
≥ 21 years old	10	33.3%
Gender		
Female	20	66.7%
Male	10	33.3%
Body Mass Index (BMI)		
Thin	5	16.7%
Normal	16	53.3%
Fat	2	6.7%
Obese	7	23.3%
Shoe Characteristics		
Suitability Scale Assessment		
Very Appropriate	7	23.3%
Appropriate	11	36.7%
Quite Appropriate	12	40%
Standing Duration		
≤ 2 hours	9	30%
2-4 hours	12	40%
≥ 4 hours	9	30%

Kendall's tau test was used to determine the relationship between suitability of shoes and low back pain. Result obtained with p-value 0.141, shows no significant relationship between two variables with correlation coefficient 0.245. (Table 2)

Table 2. Relationship between suitability of shoes and low back pain

Shoes suitability scale	Visual Analogue Scale						Total	
	Mild		Moderate		Severe			
	f	%	f	%	f	%	f	%
Very Suitable	5	35.7%	1	11.1%	1	14.3%	7	23.3%
Appropriate	4	28.6%	6	66.7%	1	14.3%	11	36.7%
Quite Suitable	5	35.7%	2	22.2%	5	71.4%	12	40%
Total	14	100%	9	100%	7	100%	30	
Correlations coefficient (Kendall's tau)							0.245	
P_value (Kendall's tau)							0.141	

Table 3 shows results of non-parametric Kendall's tau to test relationship between each shoes characteristics and low back pain. "Firmness of sole" category shows significant relationship with p-value 0.355. With p-value > 0.05, it shows that there is no significant relationship between two variables with correlation coefficient of 0.163. Heel counter shows significant relationship with p-value 0.948. With p-value > 0.05, it shows that there is no significant relationship between two variables with correlation coefficient of -0.12.

Table 3. Relationship between characteristics of shoes and low back pain

Shoe Characteristics Against Low Back Pain			
Firmness of sole	Correlation coefficient	1.000	0.163
	Sig. (2-tailed)		0.355
Heel counter	Correlation coefficient	1.000	-0.12
	Sig. (2-tailed)		0.948

Table 4 shows Kendall's tau result to determine relationship between standing duration and low back pain, obtained p-value 0.01. It shows significant relationship between two variables with correlation coefficient of 0.541. The correlation coefficient shows two variables have strong relationship, and positive correlation (unidirectional). Positive correlation indicates that the longer the duration of standing, intensity of low back pain is higher.

Table 4. Relationship between standing duration and low back pain

Standing duration	Visual Analogue Scale						Total	
	Mild pain		Moderate pain		Severe pain			
	f	%	f	%	f	%	f	%
< 2 hours	8	57.1%	1	11.1%	0	0%	9	16.7%
2 – 4 hours	5	35.7%	4	44.4%	3	42.9%	12	53.3%
> 4 hours	1	7.1%	4	44.4%	4	57.1%	9	16.7%
Total	14	100%	9	100%	7	100%	30	
Correlation coefficient (Kendall's tau)							**0.541**	
P_value (Kendall's tau)							**0.01**	

V. DISCUSION

Standing duration and low back pain have significant relationship. Longer standing duration creates more lower back pain in participants. The results of this study are in accordance with Susanti et al. (2015); discussed relationship between standing duration and myogenic low back pain in cashiers. Workers who carry out long standing activities in the same position for more than 20 minutes feel LBP. The results of this study also in accordance with Nelson-Wong (2010) conducted with15 healthy respondents who were asked to stand for 2 (two) hours continuously while they're doing 4 (four) different jobs. There were discomfort in the lower back area turned into lower back pain when respondents were asked to stand for 4 hours every day [27].

VI. CONCLUSIONS

Characteristics of shoes based on shoes suitability do not have significant relationship to LBP. Firmness of shoes sole and shoes heel counter do not have significant relationship with the LBP. Standing duration has significant relationship with LBP.

ACKNOWLEDGMENT

This study was done by self- funding from the authors. The authors thank to all partisipants and research assistant.

REFERENCES

1) Aghazadeh, J., Ghaderi, M., Azghani, M. R., Khalkhali, H. R., Allahyari, T., & Mohebbi, I. (2015). Anti-fatigue mats, low back pain, and electromyography: An interventional study. *International Journal of Occupational Medicine and Environmental Health*, *28*(2). https://doi.org/10.13075/ijomeh.1896.00311
2) Andersen, J. H., Haahr, J. P., & Frost, P. (2007). Risk factors for more severe regional musculoskeletal symptoms: A two-year prospective study of a general working population. *Arthritis and Rheumatism*, *56*(4), 1355–1364. https://doi.org/10.1002/ART.22513
3) Anderson, J., Nester, C., & Williams, A. (2018). Prolonged occupational standing: the impact of time and footwear. *Footwear Science*, *10*(3), 189–201. https://doi.org/10.1080/19424280.2018.1538262

4) Anderson, J., Williams, A. E., & Nester, C. (2020). Development and evaluation of a dual density insole for people standing for long periods of time at work. *Journal of Foot and Ankle Research*, *13*(1), 1–13. https://doi.org/10.1186/s13047-020-00402-2
5) Anderson, J., Williams, A. E., & Nester, C. (2021). Musculoskeletal disorders, foot health and footwear choice in occupations involving prolonged standing. *International Journal of Industrial Ergonomics*, *81*(July 2020). https://doi.org/10.1016/j.ergon.2020.103079
6) Anderson, J., Williams, A. E., & Nester, C. J. (2017). A narrative review of musculoskeletal problems of the lower extremity and back associated with the interface between occupational tasks, feet, footwear and flooring. *Musculoskeletal Care*, *15*(4), 304–315. https://doi.org/10.1002/msc.1174
7) Baker, M. D., & Bell, R. E. (1991). The role of footwear in childhood injuries. *Pediatric Emergency Care*, *7*(6), 353–355. https://doi.org/10.1097/00006565-199112000-00009
8) Barton, C. J., Bonanno, D., & Menz, H. B. (2009). Development and evaluation of a tool for the assessment of footwear characteristics. *Journal of Foot and Ankle Research*, *2*(1), 1–12. https://doi.org/10.1186/1757-1146-2-10
9) Darmawan, D. D. (2013). *Metode Penelitian Kuantitatif* (Cetakan ke). PT Remaja Rosdakarya.
10) Devereaux, M. (2009). Low Back Pain. *Medical Clinics of North America*, *93*(2), 477–501. https://doi.org/10.1016/j.mcna.2008.09.013
11) Dickinson, J. A., Cook, S. D., & Leinhardt, T. M. (1985). The measurement of shock waves following heel strike while running. *Journal of Biomechanics*, *18*(6), 415–422. https://doi.org/10.1016/0021-9290(85)90276-3
12) Ellis, S., Branthwaite, H., & Chockalingam, N. (2022). Evaluation and optimisation of a footwear assessment tool for use within a clinical environment. *Journal of Foot and Ankle Research*, *15*(1), 1–9. https://doi.org/10.1186/s13047-022-00519-6
13) Gabell, A., Simons, M. A., & Nayak, U. L. S. (1985). Falls in the healthy elderly: predisposing causes. *Ergonomics*, *28*(7), 965–975. https://doi.org/10.1080/00140138508963219
14) Gallagher, K. M., & Callaghan, J. P. (2015). Early static standing is associated with prolonged standing induced low back pain. *Human Movement Science*, *44*, 111–121. https://doi.org/10.1016/j.humov.2015.08.019
15) Haefeli, M., & Elfering, A. (2006). Pain assessment. *European Spine Journal*, *15*(Suppl 1), S17. https://doi.org/10.1007/S00586-005-1044-X
16) Hagen, M., & Hennig, E. M. (2009). Effects of different shoe-lacing patterns on the biomechanics of running shoes. *Journal of Sports Sciences*, *27*(3), 267–275. https://doi.org/10.1080/02640410802482425
17) Halim, I., & Rahman Omar, A. (2011). *A review on health effects associated with prolonged standing in the industrial workplaces Development of a Decision Support System for Analysis and Solutions of Prolonged Standing in the Workplace*. *July 2015*. www.arpapress.com/Volumes/Vol8Issue1/IJRRAS_8_1_03.pdf
18) Harkness, E. F., Macfarlane, G. J., Nahit, E. S., Silman, A. J., & Mcbeth, J. (2003). Risk factors for new-onset low back pain amongst cohorts of newly employed workers. *Rheumatology 42 ß British Society for Rheumatology*, *42*, 959–968. https://doi.org/10.1093/rheumatology/keg265
19) Hasan, I. (2008). Analisis Data Penelitian Dengan Statistik. Cetakan Ketiga. In *PT. Bumi Aksara. Jakarta*. Bumi Aksara.
20) Hawker, M. (2012). Pain assessment. *Developing Healthcare Skills Through Simulation*, *15*, 55–66. https://doi.org/10.4135/9781446269954.n5
21) Kendall, J. C., Bird, A. R., & Azari, M. F. (2014). Foot posture, leg length discrepancy and low back pain - Their relationship and clinical management using foot orthoses - An overview. *Foot*, *24*(2), 75–80. https://doi.org/10.1016/j.foot.2014.03.004
22) Menz, H. B., Dufour, A. B., Riskowski, J. L., Hillstrom, H. J., & Hannan, M. T. (2013). Foot posture, foot function and low back pain: the Framingham Foot Study. *Rheumatology*, *52*(12), 2275–2282. https://doi.org/10.1093/rheumatology/ket298
23) Menz, H. B., Lord, S. R., & McIntosh, A. S. (2001). Slip resistance of casual footwear: implications for falls in older adults. *Gerontology*, *47*(3), 145–149. https://doi.org/10.1159/000052788
24) Menz, H. B., & Morris, M. E. (2005). Footwear characteristics and foot problems in older people. *Gerontology*, *51*(5), 346–351. https://doi.org/10.1159/000086373
25) Menz, H. B., & Sherrington, C. (2000). The footwear assessment form: A reliable clinical tool to assess footwear characteristics of relevance to postural stability in older adults. *Clinical Rehabilitation*, *14*(6), 657–664. https://doi.org/10.1191/0269215500cr375oa

26) Nancarrow, S. A. (1999). Footwear suitability scale: a measure of shoefit for people with diabetes. In *Australasian Journal of Podiatric Medicine* (Vol. 33, Issue 2, pp. 57–62). http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=1999059157&site=ehost-live
27) Nelson-Wong, E., Howarth, S. J., & Callaghan, J. P. (2010). Acute biomechanical responses to a prolonged standing exposure in a simulated occupational setting. *Ergonomics*, *53*(9), 1117–1128. https://doi.org/10.1080/00140139.2010.500400
28) Nuryadi, Tutut Dewi Astuti, Endang Sri Utami, & Martinus Budiantara. (2017). *Dasar-Dasar Statistika Penelitian*. Sibuku Media. http://lppm.mercubuana-yogya.ac.id/wp-content/uploads/2017/05/Buku-Ajar_Dasar-Dasar-Statistik-Penelitian.pdf
29) Ogon, M., Krismer, M., Söllner, W., Kantner-Rumplmair, W., & Lampe, A. (1996). Chronic low back pain measurement with visual analogue scales in different settings. *Pain*, *64*(3), 425–428. https://doi.org/10.1016/0304-3959(95)00208-1
30) Özkan, Ö. H. (n.d.). *A Research Of Footwear and Foot Interaction Through Anatomy And Human Engineering*. Retrieved May 9, 2022, from https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.427.6698&rep=rep1&type=pdf
31) Patrianingrum, M., Oktaliansah, E., & Surahman, E. (2015). Prevalence and Risk Factors of Lower Back Pain in the Anesthesiology Workplace in Dr. Hasan Sadikin General Hospital Bandung. *Jurnal Anestesi Perioperatif [JAP*, *3*(1), 47–56.
32) Ramdas, J., & Jella, V. (2018). Prevalence and risk factors of low back pain. *Int J Adv Med*.
33) Rawls, Alan & Fisher, Rebecca, E. (2010). Development and Functional Anatomy of the Spine. *Spine, The Genetics and Development of Scoliosis*, 21–46.
34) Sevinsky, S. (2004). *Choosing Proper Footwear*. http://scottsevinsky.com/pt/presentations/inservice_footwear.pdf
35) Susanti, N., Hartiyah, & Kuntowato, D. (2015). Hubungan Berdiri Lama Dengan Keluhan Nyeri. *Jurnal Pena Medika*, *5*(1), 60–70.
36) Widiyanti, E. L., Endang, B., & Jannis, J. (2009). Lifting and transferring patient as risk factors for low back pain among female nurses. *Journal of the Indonesian Medical Association: Majalah Kedokteran Indonesia*.
37) Williams, A. (2007). Footwear Assessment and Management. *Podiatry Management*, *supplement*(October), 165–178.
38) Winata, S. (2014). Diagnosis dan Penatalaksanaan Nyeri Punggung Bawah dari Sudut Pandang Okupasi. *Jurnal Kedokteran Meditek*, *1607*(20 (54): 20-27.).
39) Yohana, V. F., & Winata, H. (2017). Pengaruh Pemakaian Sepatu Hak Tinggi terhadap Low Back Pain pada Sales Promotion Girl Di Pekan Raya Jakarta 2016. Jurnal Kedokteran Meditek, 23(62). https://doi.org/10.36452/JKDOKTMEDITEK.V23I62.1549

There is an Open Access article, distributed under the term of the Creative Commons Attribution–Non Commercial 4.0 International (CC BY-NC 4.0) (https://creativecommons.org/licenses/by-nc/4.0/), which permits remixing, adapting and building upon the work for non-commercial use, provided the original work is properly cited.