Journal of Epidemiology and Public Health (2023), 08(04): 478-486
Masters Program in Public Health, Universitas Sebelas Maret

Meta-analysis

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Meta-Analysis of the Effect of Prolonged Use of High Heels on Low Back Pain in Female Sales Employees

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Received: 20 July 2023; Accepted: 22 September, 2023; Available online: 16 October, 2023

ABSTRACT

Background: Low Back Pain is the pain that is felt from the lower back area to the lower buttocks crease area (Gluteal inferior fold). One of the causes of Low Back Pain is a prolonged and excessive use of high heels. This study aims to analyze and estimate the effect of the use of high heels on Low Back Pain in sales promotion girls.
Subjects and Method: Meta-analyses were carried out according to the PICO model. Population: female sales promotion employee. Intervention: Wearing High Heels. Comparison: Not using High Heels. Outcome: Low Back Pain. The article search in this study was conducted through databases that included PubMed, Google Schoolar, ScienceDirect. The keywords included: "Low Back Pain" AND "Low Back Pain" AND "High Heels" AND "Low Back Pain" "Employee sales" AND "High Heels" "Sales Low Back Pain" (aOR) "Employee sales" And "Employe sales" "Low Back Pain" AND "High Heels" AND "Employe sales", "High Heels AND High Heels" "Low Back pain Employee Sales" AND "High Heels". Full-paper articles with cross-sectional study design. The subjects of the study were users of high heels toward low back pain, the measure of association used was the adjusted odd ratio. The article selection used was PRISMA flow diagram. The analysis was performed using Revman 5.3
Results: A meta-analyss included 10 cross-sectional studies from Africa and Asia. Prolonged use of high heels increased the risk of low back pain in female sales promotion employee (aOR= 1.41; 95% CI= 1.16 to 1.171 p=0.001).
Conclusion: Female sales promotion employee who wear high heels have a higher risk of experiencing low back pain.

Keywords: sales promotion girl, high heels, low back pain.

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Cite this as:
Firmanurulita F, Kristiyanto A, Prasetya H (2023). Meta-Analysis of the Effect of Prolonged Use of High Heels on Low Back Pain in Female Sales Employee. J Epidemiol Public Health. 8(4): 478-486. https://doi.-org/10.26911/jepublichealth.2023.08.04.06.

BACKGROUND

The use of high heels provides a static change that is a change in posture. According to Research Lee et al. (2013) High heels can increase lumbar lordosis (curvature of the lumbar spine) and pelvic anteversion (change in the position of the pelvis), this happens because of the body's compensation in achieving balance, the fulcrum of gravity moves forward.

According to Smallwood et al. (2013) changes in the fulcrum of the body affect the kinetics and joints increasing the risk of pain in the femoral patella and ankle. Pain in this part due to the uneven distribution of pressure on the foot, the higher the shoe, the more pressure on the foot that moves from the midfoot and hindfoot towards the forefoot, thus increase the risk of falling because the plantar flexion position further increases metabolic energy during walking and accelerates muscle fatigue (Henderson P., et al 2014).

Wearing high heels, one is at risk of shortening the leg muscles due to an oblique position of the foot, a continuous tiptoe position and a deep dive forward for a long time. It makes the Achilles tendon in the posterior heel and gastrocnemius muscle shortened and tensed due to the constant contraction resistance in that region, causing changes in activity patterns in the muscles.

The use of high heels with a height above five centimeters, makes the position of the feet in a state of plantar flexion. This position can trigger constant contractions in the gastrocnemius muscle to maintain a balanced standing position thus increasing the tension in the muscle fibers and straining the gastrocnemius muscle causing pain (Safun R, 2021). This study aims to analyze and estimate the effect of high heels use on Low Back Pain in sales promotion girls.

SUBJECTS AND METHOD

1. Study Design

This study used systematic review and meta-analysis methods with analytical guidelines adapted to the PRISMA flow diagram guidelines method. The data used came from primary article searches from databases such as PubMed, Science Direct, and Google Scholar. The search was conducted using keywords including: "Low Back Pain" AND " High Heels" AND "Employee sales" AND "Sales Low Back Pain" AND "Low Back pain Employee Sale".

2. Steps of Meta-Analysis

1) Formulating PICO format research questions (Population, Intervention, Control/ Comparisons, Outcome)
2) Searching for primary study articles from various electronic and non-electronic databases such as PubMed, Google Scholar, Science Direct and so on.
3) Conducting screening, determining inclusion and exclusion criteria, and conducting critical assessments.
4) Extracting primary study data and synthesizing effect estimation using Revman 5.3 application.
5) Interpreting results and drawing conclusions.

3. Inclusion Criteria

The inclusion criteria in this study included full text articles with cross-sectional design and adjusted odds ratio (aOR), published in the period of 2007 to 2022, the study population used was high heels on low back pain, published in English and Indonesian language.

4. Exclusion Criteria

The exclusion criteria in this study were studies before 2007, non-cross-sectional study design, and articles published in non-English and non-Indonesian.

5. Operational Definition of Variables

Low Back Pain is pain felt in the lower back area between the lowest two corners to the sacrum.

The Use of High Heels is the length of time an employee works with the habit of wearing high heels, thus will have an impact on health (low back pain).

6. Study Instruments

The study was guided by PRISMA flow diagram and the quality assessment of the study articles used in the study was conducted based on worksheets of the Centre for Evidence Based Medicine (CEBM).

7. Data Analysis

Data analysis was conducted using Review Manager software version 5.3. The analysis was carried out by calculating the effect size and the value of heterogeneity consistency (I^2) of the selected study results. The results of data analysis were in the form of forest plots and funnel plots.

RESULTS

The article search process was conducted through several journal databases such as PubMed, Google Scholar, and Science Direct. The review process of related articles can be seen in the PRISMA flow diagram in Figure 1. Ten articles were obtained from the continents of Africa and Asia (Figure 2).

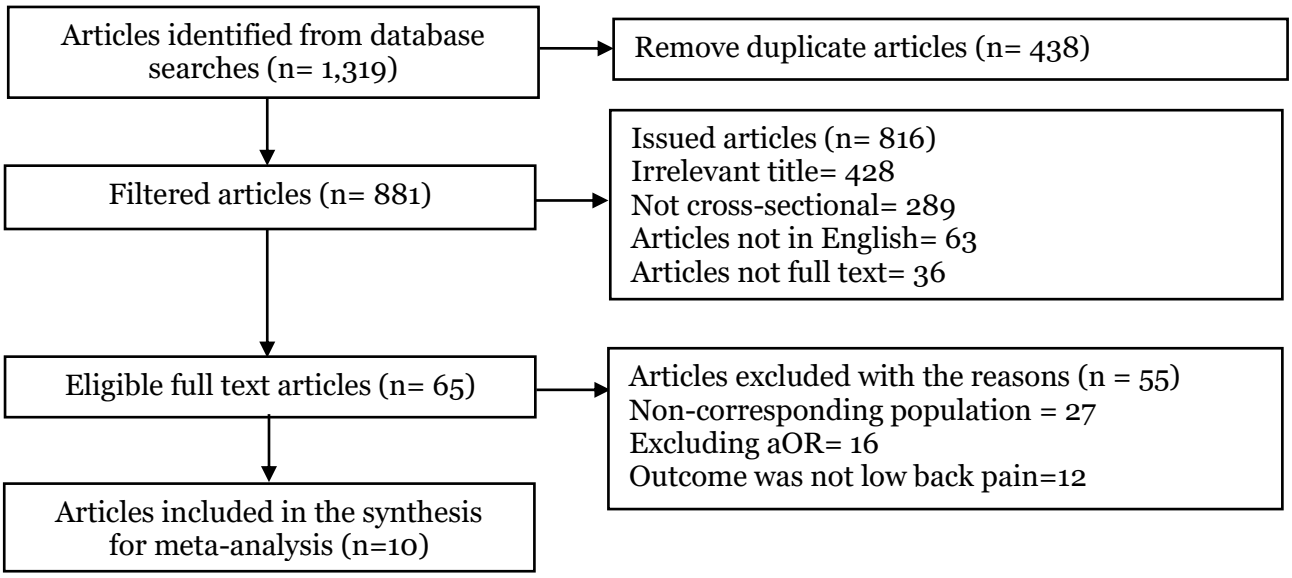

Figure 1. PRISMA flow diagram

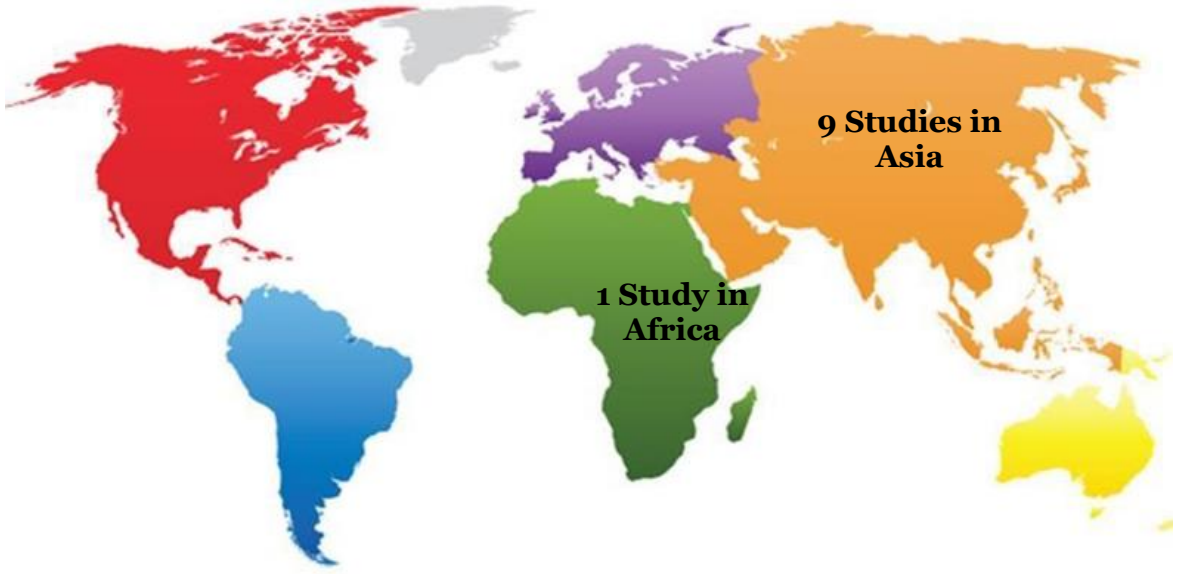

Figure 2. Map of the study area of the effect of the use of high heels on low back pain

Table 1. Quality assessment of study articles on the effect of high heels use on low back pain

Article (Year)	Question Checklist												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Tomioka et al. (2017)	1	1	1	1	1	1	1	0	1	1	1	1	11
Kim et al. (2018)	1	1	1	1	1	1	1	1	1	0	1	1	11
Shin et al. (2021)	1	1	1	1	1	1	1	1	1	1	1	1	12
Seo et al (2021)	1	1	1	1	1	1	1	0	1	1	1	1	11
Lee et al. (2018)	1	1	1	1	1	1	1	1	1	1	0	1	11
Negash et al. (2022)	1	1	1	1	1	1	1	0	1	0	1	1	10
Park et al. (2020)	1	1	1	1	1	1	1	0	1	1	1	1	11
Shima et al. (2021)	1	1	1	1	1	1	1	1	1	1	0	1	11
Jo et al. (2021)	1	1	1	1	1	1	1	1	1	1	1	1	12
Jeong et al. (2018)	1	1	1	1	1	1	1	1	1	0	1	1	11

Description of the question criteria:

1 = Does the study address the focused issues clearly?
2 = Are *cross-sectional* study methods appropriate to answer research questions?
3 = Were there enough subjects in the study to establish that the findings were not done by chance?
4 = Was the *cross-sectional* selection based on objective and validated criteria?
5 = Was the *cross-sectional* representative of the designated population?
6 = Was the follow-up conducted in sufficient time?
7 = Were objective and unbiased outcome criteria used?
8 = What is the low back pain intervention measurement method?
9 = Is the effect size practically relevant?
10 = Is there any confidence interval provided?
11 = Have confounding factors been taken into account?
12 = Do the results applicable to your research?

Description of the answer score:

0 = No
1 = Yes

After assessing the quality of the studies, a total of 10 articles with a cross-sectional study design were obtained which will be used as the source for a meta-analysis of the effect of the use of high heels on low back pain. The source of the articles comes from 2 continents, namely Asia and Africa. The articles were subsequently extracted and summarized according to PICO research.

Table 2. Summary of cross-sectional primary study articles with the respective PICO (N= 240,364)

Authors (Years)	Countries	Sample	P	I	C	O
Tomioka et al. (2017)	Japan	35,870	Sales employees, professionals, services	Wearing High Heels	No High Heels	Low Back Pain
Kim et al. (2018)	Korea	40,752	Private employees	Wearing High Heels	No High Heels	Low Back Pain

Authors (Years)	Countries	Sample	P	I	C	O
Shin et al. (2021)	Korea	14,045	Sales employee, manager	Wearing High Heels	No High Heels	Low Back Pain
Seo et al. (2020)	Korea	27,163	Sales employees	Wearing High Heels	No High Heels	Low Back Pain
Lee et al. (2018)	Korea	11,890	Sales employee, professional worker	Wearing High Heels	No High Heels	Low Back Pain
Negash et al. (2022)	Ethiopia	423	Healthcare employees	Prolonged standing in high heels	No High Heels	Low Back Pain
Park et al. (2020)	Korea	30,060	Sales employee, manager	Wearing High Heels	No High Heels	Low Back Pain
Shima et al. (2021)	Japan	20,028	Sales employees	Wearing High Heels	No High Heels	Low Back Pain
Jo et al. (2021)	Korea	32,970	Part-time employee, full-time employee	Wearing High Heels	No High Heels	Low Back Pain
Jeong et al. (2018)	Korea	27,163	Sales employees	Wearing High Heels	No High Heels	Low Back Pain

Table 3. Adjusted Odds Ratio (aOR) of the effect of using high heels on low back pain (N=240,364)

Authors (Years)	aOR	95% CI	
		Upper Limit	Lower Limit
Tomioka et al. (2017)	1.42	1.18	1.71
Kim et al. (2018)	2.17	2.02	2.34
Shin et al. (2020)	0.88	0.63	1.23
Seo et al. (2020)	1.06	0.77	1.46
Lee et al. (2018)	1.47	1.32	1.64
Negash et al. (2022)	1.81	1.08	3.03
Park et al. (2020)	1.06	0.92	1.22
Shima et al. (2021)	1.42	1.18	1.71
Jo et al. (2021)	1.25	1.07	1.46
Jeong et al. (2018)	2.00	1.80	2.20

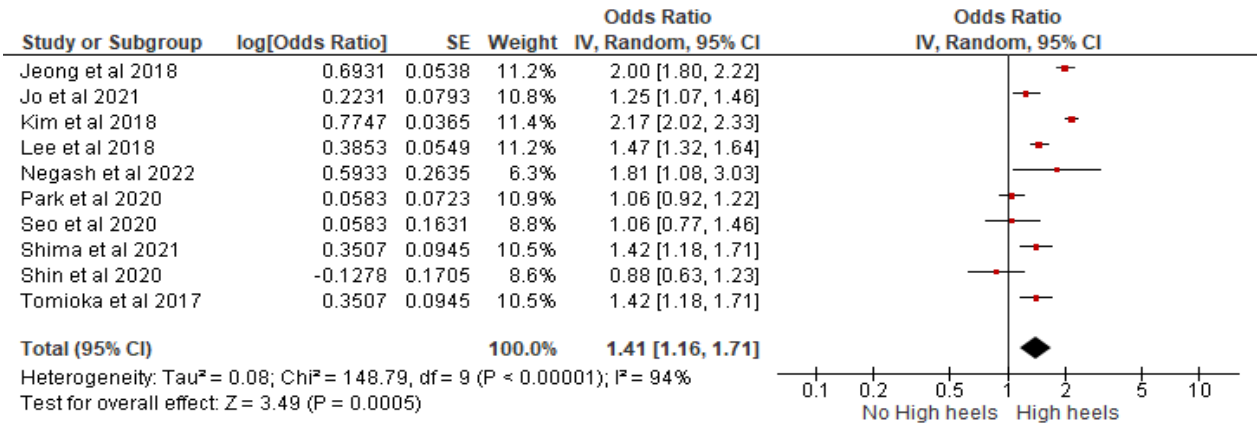

Figure 3. Forest plot of meta-analysis of the effect of high heels use on low back pain

The forest plot in Figure 3 shows there was an effect of wearing high heels on low back pain. Sales promotion girls who wore high heels were 1.41 times more likely to experience low back pain compared to those who did not wear high heels, and the

effect was statistically significant (aOR = 1.41; CI 95%= 1.16 to 1.71; p= 0.005). The forest plot showed heterogeneity of effect estimates across studies was high (I^2= 94%; p<0.001). Thus, a random effect model approach was used for the calculation of the average effect estimates.

The funnel plot in Figure 4 shows an asymmetrical distribution of effects to the right and left of the vertical line of average estimates. Effect estimates are more widely distributed to the right of the vertical line than to the left, indicating publication bias. Because the distributions of the effect estimates are more to the right of the vertical line, the same as the average location of the effect estimates (diamond shape) which is also located to the right of the vertical line in the forest plot, the bias of the publication tends to overestimate the effect.

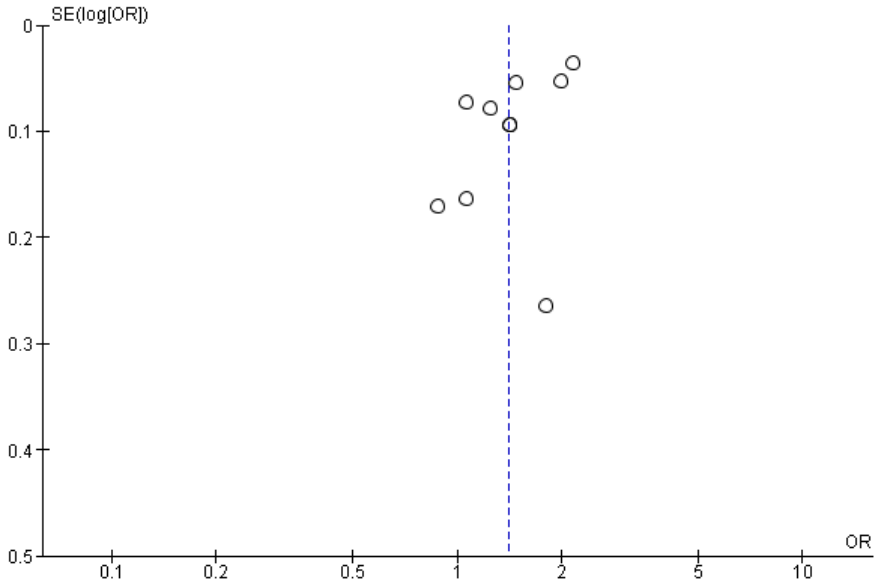

Figure 4. Funnel plot of meta-analysis of the effect of high heels use on low back pain

RESULTS

It was a meta-analysis study related to the risk of using high heels on low back pain in sales promotion girls, with the dependent variable was sales promotion girls who wore high heels during their work. This study is in line with Halimatussyadiah et al. (2018) which explains that sales promotion girls who work wearing high heels are 6 times more likely to experience low back pain compared to those who are wearing flat shoes (p <0.001).

The results of the meta-analysis conducted on 10 study articles showed that sales promotion girls who wore high heels were 1.41 times more likely to experience low back pain compared to sales promotion girls who did not wear high heels. The results of this study are similar to a study by Jo et al. (2021) entitled negative impacts of prolonged standing at work on musculoskeletal symptoms and physical fatigue: the fifth Korean working conditions survey". KWCS obtained data of 32,970 full-time employees who have worked for more than one year.

Employees were divided into groups based on how often they rest, whether they carry heavy loads or perform repetitive movements that overload the musculoskeletal system and the use of high heels that would cause low back pain. The result for full-time employees surveyed is that 48.7%

works in standing positions for more than half of their total working time. The adjusted odds ratio (aOR) value of female employees who work in a prolonged standing position and carry heavy loads are at higher risk of low back pain and lower extremity pain compared to female employees who work without carrying heavy loads (OR = 1.43; CI95%=1.151 to 1.788).

It is also in line with a study by Negash et al. (2022) that aims to assess the prevalence and factors associated with low back pain among healthcare employees. The cross-sectional study method was conducted on 423 health employees who participated in the period of March 20, 2021 to April 20, 2021. A multivariate logistic regression model was used to identify factors associated with low back pain prevention, p=0.005, and a confidence interval 95%. Based on the results of this study, the adjusted odds ratio (aOR) value is that female health professional employees are at higher risk of low back pain than male ones (aOR= 1.80; CI95% = 1.70 to 3.01). The value of adjusted odds ratio (aOR) is 2.6 times more likely to experience low back pain among health professional employees who work in long standing position compared to those who do not stand long (aOR=2.60; 95% CI= 1.48 to 4.59).

This study can conclude that sales promotion girls who wear high heels are 1.41 times more likely to experience low back pain compared to sales promotion girls who do not wear high heels (aOR= 1.41; CI 95%= 1.16 to 1.17; p= 0.005). This meta-analysis showed high heterogeneity of effect estimate across studies (I^2= 94%; p<0.001). Thus, the calculation of the average effect estimates was conducted using a random effect model approach.

The limitation of the study is the study only uses English articles to be analyzed, thus ignoring non-English publiccation articles. It uses three databases (Pubmed, Google Scholar, and Scopus) thus ignoring the other the databases.

AUTHOR CONTRIBUTION

Fadhila Firmanurulita was the main researcher who selected topics, searches, and collected study articles. Agus Kristiyanto and Hanung Prasetya analyzed the data and interpreted the results of the meta-analysis data synthesis.

ACKNOWLEDGEMENT

We would like to express our gratitude to the providers of PubMed, Science Direct, and Google Scholar, for providing an open access database of article publications.

FUNDINGS AND SPONSORSHIP

The study was self-funded.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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