

Effect of Stretching and Strengthening on Low Back Pain among High Heels Using Young Females

Lokesh R¹, Senthil SELVAM P², M S Sundaram³, Reshma⁴

¹PhD, Assistant Professor, SOPT, VISTAS, Chennai, India

²PhD, Professor & HOD, SOPT, VISTAS, Chennai, India

³PhD, Professor, SOPT, VISTAS, Chennai, India

⁴BPT Internne, SOPT, VISTAS, Chennai, India

Abstract: Low back pain is common problem that affect the public health .Low back pain can be avoided by maintenance of good posture and good transferring technique using foot wear. This study aim's to know about the effect of stretching and strengthening on Low Back Pain among high heels using young females. To reduce Low back pain and also calf muscle tightness, improve the calf flexibility and strengthen the abdominal muscle. **Materials and methods:** A comparative experimental study was conducted at School Of Physiotherapy VISTAS. 30 participants were selected based on inclusion criteria using convenient sampling method were divided into two groups Group A – Stretching (Experimental group) & Group B – Strengthening (Experimental group),both groups 4weeks of intervention period. **Result:** The result showing that there was a significant improvement in both groups $p < 0.05$. **Conclusion:** The results were showing although both groups were showing significant improvement, but when comparing both groups statically Group B is effective than Group A.

Keywords: Low back pain, High heels, Stretching Exercises, Strengthening Exercises.

1. Introduction

Low back pain is common problem that affect the public health. Low back pain (LBP) is characterized by pain or discomfort in the lumbar region, occur below the costal margin and above the gluteus fold that may or may not radiate to the thigh.

Classification based on the duration or symptoms.

- 1) Acute: less than six weeks
- 2) Sub-acute: 6-12 weeks
- 3) chronic: more than 12 weeks

During the early 21st century, woman started to wear high heels in order to satisfy their desire to be more beautiful and fashionable.[1]The use of high heels is being a common habit increasing gradually among the adults High heels is the one of essential part of woman's fashion that reflects the personality. The foot wear change the woman's posture and gait. Low back pain can be avoided by maintenance of good posture and good transferring technique using foot wear. This result is similar with previous research by pannell SL, where the percentage of female who wear high-heels were found highest between the age group of 18-24 years, as much as 49%.[2]As is known, the etiology of LBP, is multifactorial ,be it anatomical position or pathological process.

High heels greatly affects the lumbar curve, increase loading on tibialis anterior muscle & distrub center of body. High heels causing increased weight bearing on toes, ankle sprains and leg pain and back pain. It affects the stride length, walking speed, abnormal gait. High heels wearing also increase lumbar lordosis and increase compressive forces on lumbar vertebrae's that leading to Lumbar spondylosis. During stance phase with high heel and increased weight

bearing on ankle, knee & hip joints. Most high heels users were between the age of 20 to 25 years old, as much as 65%.This age is a productive age.

Anatomically the most often etiology of LBP include any disease or injury of the muscle, fascia, ligament, bone, joint, disc and spinal nerve. The negative side effects of high heels shoes on the body mechanics and might related to other factors such as malnutrition, deficiency of vitamin D, Lack of physical exercise and transferring or carry objects with wrong posture.^[4]

Weak abdominal muscle cause hip flexor, muscles to tighten causing an increase in the curve of Low back. Unhealthy posture and muscle imbalances can lead to Low back ache. The good abdominal muscle strength maintaining the pulmonary function and reducing low back pain.

- **Stretching:** Any therapeutic maneuver designed to lengthen pathologically shortened soft-tissue structures and thereby increase range of motion (kisner and Colby 1996).
- **Strengthening Exercises:** Strengthening Exercises at increasing the torque-producing capacity (or) endurance at a specific muscle (or) muscle group.

2. Methodology

Study Design: Experimental study.

Study Type: Comparative study.

Sampling Technique: Convenient sampling.

Sample size: 30 Females.

Study Duration: 4Weeks.

Study Setting: School Of Physiotherapy, VISTAS.

2.1 Sample Selection

Inclusion Criteria:

- College students Females.
- Age over 18years-25 years
- High Heels Users with Low back pain (Heel height upto 6 to 7cm).

Exclusion Criteria:

- Un-cooperative Subjects.
- Recent Surgeries over Ankle & Foot.
- Orthopaedic Conditions like Fracture & osteoporosis over Ankle & Foot.
- Any Surgeries & injuries over low back.
- Male Gender.

Tools Used:

- Inch Tape.
- Universal Goniometer.

2.2 Procedure

30 participants are taken for this study based on the inclusion and exclusion criteria, after getting informed consent, the participants were divided into two groups. Group A –15 participants; GroupB – 15 participants. And both group participants were assessed with NPRS, Revised Oswestry low back pain questionnaire. For Group A assessed with Range of motion for Ankle Dorsiflexion. For Group B assessed with Strength of abdominal muscle. Group – A participants were treated with static stretching for calf muscles, Group – B participants were treated with abdominal strengthening exercises. Both the groups were receive intervention for about 4 weeks including 3 days in a weeks, with 30 seconds of treatment time per day for Group A. For Group B treated with 4 weeks and duration (10) reps and 5sec hold.

After the 4 weeks of intervention period both the participants were assessed with again NPRS, oswestry low back pain questionnaire, and Range of motion of Ankle Dorsiflexion and Adbominal muscle strength. And the results were interpreted

2.2.1 Exercise Protocol

Stretching Procedure: Weight Bearing Lunge test by using goniometer for ankle range of motion measurement.

Before stretching exercises = give warm up exercises.

After stretching exercises = give cool down exercises.

Warm Up	Stretching	Cool Down
10minutes walking & jogging	7minutes static stretching	3 minutes relaxation and walking

2.2.2 Measurement of Calf Muscle

Weight Bearing Lunge Test:

The test was performed in a standing position with the heel in contact with the ground, the knee in line with the second toe and greater toe 10cm away from the wall. Balance was maintained by allowing contact with the wall using two finger from each hand. Participants were asked to lunge

forward directing their knee towards the wall until their knee touched the wall. While the participant maintained her maximal dorsiflexion position. That time measure the range of motion using the goniometer.

Static Stretching: (Group A)

The subject stood with one leg in front of the intervention leg. Placed the hands against a wall and slowly moved forwards the wall by bending the front leg further whilst keeping the knee on the intervention leg straight with the heel pressed to the floor. The subjects hold the maximally stretched calf muscle in the each position for 30sec followed by a 10sec rest stretch was repeated 5times at one session.

Strengthening Exercise for Abdominal Muscle

- Sit up from supine position with hips and knees flexed.
- Head and shoulder are lifted with a gradual curl to the knees with the hands
- Abdominal muscle becomes more efficient.

Thus, isotonic abdominal exercise should begin with the hips and knee flexed.

2.3 Statistical Analysis

Group A (Stretching)

Table 1: Shows intragroup analysis of Oswestry questionnaire, NPRS, ROM of ankle

Outcome Measure	Mean Value		Standard Deviation		t-value	p-value
	Pre Value	Post Value	Pre Value	Post Value		
Oswestry Questionnaire NPRS	8.00	32.73	5.55	6.87	-15.13	0.000
	5.45	3.73	0.642	0.942		
Dorsi Flexion Rom(Leftleg)	68.67	84.67	25.317	23.258	-2.51	0.013
Dorsi Flexion Rom (Rightleg)	70.00	81.33	22.6	23.86	-2.20	0.023

Group B (Strengthening)

Table 2: Shows intragroup analysis of Oswestry questionnaire, NPRS, Abominal muscle strength

Outcome Measure	Mean Value		Standard Deviation		t-value	p-value
	Pre Value	Post Value	Pre Value	Post Value		
Oswestry Questionnaire NPRS	14.87	43.67	6.010	9.693	-15.93	0.000
	4.14	1.87	1.170	1.356		
Abdominal Strength	1.33	5.47	1.175	1.246	-31.00	0.000

3. Result

The *t* value for OSWESTRY Questionnaire and NPRS was found to be -15.13 and 8.22 respectively in case of Group A and for Group B was found to be -15.93 and 12.70 respectively.

The *p* value for OSWESTRY Questionnaire and NPRS were found to be $p < 0.05$ in Group A.

The t value of calf muscle tightness for left and right leg dorsiflexion ROM were found to be -2.51 and -2.20 respectively and p value were found to be $p < 0.05$.

The t value for Group B was found to be -31.00 and p value $p < 0.05$

4. Discussion

Low Back Pain (LBP) is defined as pain and discomfort in the lumbosacral region, below the twelfth rib and above the gluteal crease. The cause of low back pain usually occurs due to the strain of muscles or ligaments.

The factors influencing factors for Low Back Pain are social factors, psychological factors, biophysical factors. High heels greatly affects the lumbar curve, increase loading on tibialis anterior muscle & disturb center of body. Biomechanics of the lumbar spine. In prolonged high heel wear, chain of events around the ankle were observed, like increased ankle plantar flexion which in turn lead to an increase in a lordotic curve.

This study concluded that calf muscle stretching and abdominal muscle strengthening exercise in Group A

Study conducted by Hadeel AL Serhany, et al., (2015) concluded that Low back pain and disability for women who are wearing high heeled shoes regularly are higher than women are wearing flat shoes.

Another study conducted by Augusto Souza Casarin, et al (2014) concluded that decreased lumbar lordosis showed that high heels are not responsible for lumbar hyperlordosis. However, it does not prevent development of Low Back Pain.

The mean improvement in Oswestry score in Group A is 24.73 and Group B is 28.80. The mean reduction NPRS is 1.72 Group A and Group B is 2.27.

The mean difference of the Dorsiflexion in Left and Right Leg were found to be 16.00 and 11.33 respectively. The mean difference of the abdominal strength was found to be 4.14 respectively.

In prolonged high heels wear, chain of events around the ankle were observed, like increased ankle plantar flexion which in turn lead to an increase in lordotic curve.

The muscular behavior of the gastrocnemius muscle was higher than the erector spinae muscles remain isometrically contracted. While high heeled shoes were worn, keeping the ankle in plantar flexion. The muscle fibers are shorter when standing in high heels. Increased plantar flexion cause a kinetic chain of compensation up to the lower extremity that ends with hypertonic psoas muscle producing a lumbar hyperlordotic lumbar spine in turn lead to backpain.

Abdominal muscle is large group of muscle in the front of abdomen that assists in the regular breathing movement and supports the muscle of the spine.

Wearing of high heels weakened the abdominal muscle. Abdominal muscles supports the trunk. The result of longer periods of time wearing high heels cause weakens the abdominals. It creates stress over back extensors and to compensate lumbar function the abdominal muscle get weaker due to overuse.

5. Conclusion

The study concluded with both stretching and strengthening are reducing the Low back pain. But, when comparing both groups statically Group B (strengthening) is effective than Group A (stretching).

6. Limitation

- Small sample size
- This study has not measured body mass index of participant.
- Short follow up.
- Short study duration.
- Outcomes measures are limited.
- Research is done only among a particular age group.

7. Recommendations

- Educate people about good properties of foot shoes which can maintain the posture and healthy body in general.
- In Further studies, advising people about role of physical exercises, fitness and good nutrition in helping the body to be healthy and prevent functional limitations during the youth.
- Further clinical trial with more samples with long term follow up including control group may help to further delineate.

References

- [1] Hadeel AL Serhany, Fahaad AL Anazi :Effect of prolonged wearing high heeled shoes on occurrence of Low Back Pain(LBP) and disability among females in AL Jouf city. International Journal of Advanced Research, Volume 3; ISSN 2320-5407.
- [2] Andhika Rezky Bahizal, Meiyanti: Association Between Heel-height and Low back pain in sales promotion Girls. Indonesian Journal of Medicine and Health, DOI: 10.20885/JKKL.Vol8.Iss3.art9.
- [3] Farjad Afzal, Sidra Manzoor: Prolong Wearing of High Heeled Shoes can Cause Low Back Pain. Journal of Physiotherapies, Volume 7. Issue 4. 1000356
- [4] A C Broega, M Righetto; Female high heel shoes et al: a study of comfort 232001, <https://www.researchgate.net/doi/10.1088/1757-899X/254/23/232001>
- [5] Samia Ali El-Nagar, Maha Mohamed Mady 1: School Bag Usage, Postural and Behavioral Habits and its effect on backpain occurrence among school children; American Journal of Nursing Science 6(3):218-231.
- [6] Emily A. Hall, Carrie L. Docherty :Validity of clinical outcome measure to evaluate ankle range of

- motion during the weight-bearing lungetest. MedSport, <http://dx.doi.org/10.1016/j.jsams.2016>
- [7] Seung-Hyun Hyun, Young-Pyo Kim and Che-Cheong Ryew :Effect on the parameters of the high-heeled shoe and transfer time of ground reaction force during level walking Oct 31 ,Journal of Exercise Rehabilitation, doi:10.12965/jer.1632592.296.
- [8] Dr. Shireen Khanzada, Dr. Saania kanwal khanzadal: Revalence of Backache among School going Children of Hyderabad, Sindh. IJPHY, Int J Physiother. Vol3(1), 11-14, February. ISSN:2348336.
- [9] Bucaramanga :Association between the sitting posture and back pain in college students, Oct/Dec. www.researchgate.net, DOI:10.18273/revsal.v48n4-2016003.
- [10] Vijay Kage, B. B. Putti: Effectiveness of Stretching and Strengthening exercises (Janda's Approach) in subjects with postural backache et al: A Randomized Controlled Trial Int J Physiother Res 2015 International Journal of Physiotherapy and Research, Vol3(6):1301-06. ISSN 2321-1822.
- [11] N Venkatesh Kumar, Chandralingam Prasana :High Heels Footwear causes Heel pain and Back pain: Myth or Reality? International Journal of Scientific Study, IJJOSS. Nov 2015/vol 3/Issue 8
- [12] Cezar Augusto Souza Casarin, Danilo Sales Bocalini :Relationship between wearing high-heeled shoes and Gastrocnemius and Erector spinae Muscle Action and Lumbar Lordosis. Medical Science Technology, ISSN 1895-2089 Med Sci Tech, 2014;55;7121.
- [13] Mr. Nezar Al-Toriri, Sharick Shamsi :Effect of Plantar Flexor Stretching in Low Back Pain Management, IOSR Journal of Nursing and Health Science (IOSR-JNHS), e-ISSN:2320-1959, p-ISSN:2320-1940 Volume 4, Issue 2 Ver. II, PP 14-25
- [14] Nicolas Gueguen :High Heels Increase Women's Attractiveness, Arch Sex Behav, DOI 10.1007/s10508-014-0422.
- [15] Janhavi, Sirsat :Prevalence of Back Pain among high school students: A cross-sectional study in Dubai, United Arab Emirates, Gulf Medical Journal, GMJ, ASM 2014;3(S2):S16-S23
- [16] Monica R.O.G.C.M. Silva, Ana Fatima V. Badaro: Low Back Pain in adolescent and associated factors et al: A cross sectional study with school children, Brazillian Journal of Physical Therapy. 1590/bjpt-rbf.2014.0051.
- [17] Hylton B. Menz, Alyssa B. Dufour :Foot posture, foot function and low back pain: the Framingham Foot Study. Oxford Journal, doi:10.1093/rheumatology/ket298
- [18] John F. Grady, DPM, FACFT :Effect of Stretching the Gastrocnemius Muscle, The Journal of Foot Surgery, VOLUME 30, NUMBER 5, 1991.
- [19] C.I. Morse, H. Degensl: The acute effect of on the passive stiffness of the human gastrocnemius muscle tendon uni, The Authors Journal compilation. The Physiological Society, J physiol 586.1, pp97-106
- [20] Karl Landorf, Rachele Buchbinder :Effectiveness of calf stretching for the short-term plantar heel pain : A randomized trial. <http://www.biomecentral.com>. 1471-2474/8/36, DOI:10.1186/1471-2474-321.
- [21] Mathias Haefeli, Achim Elfering :Pain Assessment D, 1. doi:10.1007/s00586-005-1044
- [22] Robert Gunzberg, Federico Balague: Low back pain in a population of School children. <https://www.researchgate.net>, DOI:10.1007/soo5860050202
- [23] Rod S Kuo, Robert Price: Isolated Gastrocnemius Tightness. The Journal of Bone & Joint surgery JBJS.ORG. VOLUME 84-A. NUMBER 6. JUNE 2002. Tightness.
- [24] Teddy W. Worrell, Maureen McCullough: Effect of Foot Position on Gastrocnemius/Soleus stretching in subjects with Normal Flexibility. Journal of Orthopaedics and Sports, Volume 19. Number 6.4
- [25] Yasufumi HAYASHI :Physical Therapy for Low Back Pain. Japan Medical Association, JMAJ, May 2004- Vol. 47, No. 5, pages 1800-1803.
- [26] Guerhazi, M., Mezghani M :The Oswestry index for low back pain translated into arabic and validated in a arab population. The Open Orthopaedics Journal, Vol 48(1), P1-10.
- [27] Lee. C. Jeong. E and Freivald: Biomechanical effects of wearing high-heeled shoes, International Journal of Industrial Ergo. 28(2001), 321-326.
- [28] Kisner C, Colby L. A :Therapeutic Exercise, 5th Edition, Jaycee Publications.
- [29] Cuthbert S, Good heart Jr, G J.: On the reliability and validity of manual muscle testing: a literature review. Chiropractic and Osteopathy, 2007; 15(4):1-23.
- [30] Du Vries J: Evaluation of static stretching procedures for improvement of flexibility, Journal Research Quarterly: American Association for Health, Physical Education and Recreation, Volume 33, 1962, Issue 2.

Author Profile



Dr. Lokesh R, MPT (cardio), PhD research scholar, Assistant Professor, SOPT, VISTAS, Chennai, having more than 3 years of academic experience and involved in research activities. Published many articles in national and international journals.



Dr. P Senthil Selvam, MPT (Ortho), PhD, Professor and HOD, SOPT, VISTAS, Chennai, having the experience of more than 11 years in academics. Guiding 8 PhD research scholars. Published many articles in the national and international journals