

A Study on Impact of High Heels on Gait Parameters and Postural Deviations of Lumbar Region in Young Adult Females

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OBJECTIVE: The study to examine the comparison between wearing ground heel shoes and wearing high heel shoes on selected gait parameters and postural deviations of lumbar region in young adult females.

DESIGN: This is a prospective randomized study and it is a descriptive observational study design comparative in nature.

METHODOLOGY: Thirty subjects aged between 18-25 years of young adult females are wear ground heel shoes and wear high heel shoes selected from Cherraan's institute of health science, Coimbatore. Group A (15 Subjects) participants have wearing ground heeled shoes and Group B (15 Subjects) participants have wearing high heeled shoes. The measurements were taken by inch tape and stop watch for gait parameters [stride and step length, cadence, base width and velocity] and wall test for lumbar lordosis.

RESULT: Statistical analyses done by using mean values showed that there was significant difference in gait parameters and postural deviation of lumbar region for wearing high heeled shoe females.

CONCLUSION: It concluded that wearing high heeled shoes females have there was significant difference in gait parameters and postural deviations of lumbar region such as decrease stride length, step length and velocity, base width widen, increase cadence and lumbar lordosis. So, we have to bring awareness to reduce side effects associated with high heels.

Keywords: High heels; Gait parameters; Postural deviations; Fashion health.

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I. Introduction

In the past Persian warriors have worn high heels in order to sit stable on the horseback. However, since the mid-nineteenth century, high heels have been predominantly worn by women[1]. Today the western world they are slowly turning into women's everyday shoes and due to fashion trends the heel height is continuously getting higher.

A women wearing high heel looks more elegant, graceful, stylish and looks aesthetical taller, slender. Surveys have shown that up to 69% of women regularly wear high-heeled shoes[2].

High heel shoes are a type of footwear typically worn by ladies where the heel of the foot is raised significantly higher than the ball of the foot and the toes. High heel forces your body weight to be thrown forward and make your legs, feet, hip and spine work against the way they were designed to work[3].

Historically, the use of high heeled shoes is purported to have started during the 14th century when wooden slippers called platens were placed on the bottom of footwear to protect them from getting dirty. Ever since then females across all ages, culture, society and religion have continued to use high heeled shoes[4].

However, whether it is to gain a height advantage, look professional or stay with the trend of fashion. For more than 250 years now, the effects of heel height on the wearer's health have become a source of concern[5]. A closer subject look around our environment shows that its usage among females is being more common, the heeled shoes are getting more steeper with toe boxes getting more pointed[6].

It is well known that high heels are not a good complement for women's health and that their frequent use has negative effects. When wearing heels, the upper body is shifted forward. This causes a misalignment of the hips and spine, as well as an increased pressure on the knees and a major adaptation that takes place is the increased curvature in the lower back[7].

This will definitely impact on their pattern of walking [gait] and postural alignment [commonly in lumbar region]. The normal lumbar lordosis affected by wearing excessively high heels causes compensatory changes in the shape of the rest of the spine producing increasing lumbar lordosis.

This increased curve can itself cause significant muscle tension and low back pain. An estimated 78% of women regularly walk in high heel. However, up to 58% complain about low back pain which is commonly thought to be caused by increase lumbar lordosis[11].

H H MERRIFIELD conduct the study about gait patterns of 12 women were compared during walking in flat shoes and in shoes with high heels. In addition, four anthropometric measurements were recorded. Results showed that the wearing high heels caused a significant decrease in step length and stride length, whereas there was a minimum change in the stride width and foot angle.

MADUABUCHI JOSEPH NWANKWO evaluate the effects of different heel heights on selected gait parameters in a sample of young Nigerian females. 80 healthy females are selected. An ex post facto design was used to investigate the effect of different heel heights on selected gait parameters. Measurements of gait parameters were taken with a tape rule and stop watch respectively. He concluded that significant difference between gait parameters such as decrease stride and step length, cadence increased and the stride width widens.

SILVA AM.ET AL studies regarding effects of high heeled shoes on body posture of adolescents. 20 subjects were selected frequent use of high heeled shoes. To measure the body posture alignment for wearing high heeled shoes in adolescent can lead to the development of postural disorders among which stands out the forward head posture, lumbar hyperlordosis, pelvic antiversion and knee valgus

OPILA KA conducted study on nineteen subjects under two conditions of footwear were analyzed for differences in the location of the LOG of the body with respect to anatomical landmarks. Intra subject comparison of barefoot and high heeled stance showed that the wearing of high heeled caused lumbar flattening, a backward tilting pelvis, decrease in distance of knee and ankle LOG and posterior displacement of the heeled and thoracic spine. Results showed change in the lumbar lordosis measured in high heeled stance is inconsistent with clinical findings of hyperlordosis in habitual wearers of high heeled shoes.

The primary aim of our research, program is to compare wear ground heel shoe and wear high heel shoe on selected young adult undergraduate females to check their gait parameters and postural changes.

Purpose of this study is to bring awareness for high heel wearing females, because it leads to: Muscle weakness [calf and back muscle], Increase knee and hip pain, Increase risk of OA, Chronic low back pain, poor balance and risk of falling down.

It is recommended that to maintain comfort and reduce adverse side effects associated with wearing different heel height, female are advised to minimize putting on high heeled shoes.

AIM OF STUDY

The aim of our research program is to analyze the influence of wearing high heeled shoes on gait parameters and lumbar lordosis among young adult females.

OBJECTIVES OF THE STUDY

Objectives of the study to examine the comparison between wearing ground heel shoes and wearing high heel shoes on selected gait parameters and postural deviations of lumbar region in young adult females.

NEED FOR THE STUDY

There have been numerous high heel shoe studies conducted previously that have found decreased in lumbar lordosis or no significant changes in lordosis [Bendix, Sorenson and klaussen;1984] and Other studies found increased in lumbar lordosis with heels [Lee, Jeong and Freivalds, 2005] and changes in gait parameter women wearing high heel [Maduabuchi Joseph Nwankwo, 2012].

Further confusing, we have to conduct a study on impact of high heels on gait parameters and postural deviations of lumbar region in young adult females.

II. Materials And Methodology

MATERIALS USED

- Measuring tape (cm)
- Centimeter scale
- Stop watch
- Weighing scale
- Pencil
- Paper

METHODS

STUDY DESIGN

- Descriptive observational study design comparative in nature.

STUDY SETTING

- The study was conducted in Cherraaan's institute of health science.

STUDY DURATION

- The study was conducted for a period of 6 months.

POPULATION AND SAMPLING

- 30 subjects were selected by convenient sampling method.

CRITERIA FOR SELECTION OF SUBJECTS

INCLUSION CRITERIA

- AGE GROUP: 18 to 25 years of females.
- Those who wear ground heel shoes.
- Those who wear high heel shoes.

EXCLUSION CRITERIA

- Deformities
- Musculoskeletal disorder
- Fractures

PARAMETER FOR ANALYSIS

- Gait parameters measurements using inch tape and stop watch
- Stride length
- Step length
- Cadence
- Base width
- Velocity
- Wall test

PROCEDURE

WALK TASK FOR GAIT PARAMETERS:

- The participants were first asked to walk bare footed before walking on ground heeled shoes and high heeled heel shoes. **GROUP A** and **GROUP B** participants walk on the barefoot.
- Examiner explained while demonstrating the walk task to each of the participants: when I say go walk at your normal comfortable pace until I say stop.
- The examiner assistant assisted the participants as needed in placing their toes on the starting line tape.
- The examiner would say go the assistant press the stop watch to begin timing while they counting the number of steps.
- The examiner measures the walking speed of the participants.
- After walk, the other gait variables such as step length, stride length, stride widen and velocity of walking were measured with the help of a tape measure following the barefoot foot prints

WALL TEST FOR LUMBAR LORDOSIS

- Instruct them to stand with the back against the wall with heels, buttocks, shoulders and head touch the wall and place your hand palm down on the wall and slide it behind the lower back. Evaluate the space between the lumbar spine and the wall.
- When a person has an acceptable degree of lumbar lordosis, you should only able to slide your fingers behind the lower back up to and in line with the second or third knuckle of your hand.
- If the space between the back and the wall is big enough for you to slide your whole hand or arm through then the participants has excessive lumbar lordosis. The greater space is between the wall and the lower back, the more extreme the deviation or imbalance is.
- The space between the back of lumbar spine and the wall is measured by finger width slide using of centimeter scale.

DATAANALYSIS AND INTERPRETATION

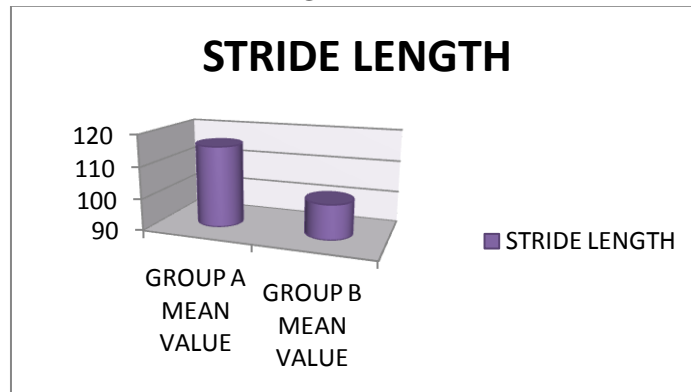
Data analysis is a method of evaluation in the research study. In the study evaluating the data is through the descriptive statistical method.

COMPARISON OF GROUP A [WEARING GROUND HEELED SHOE] AND GROUP B [WEARING HIGH HEELED SHOE] VALUES - IN STRIDE LENGTH

TABLE-1

S.NO	GROUP	MEAN VALUE
1	A	115.67
2	B	100.93

GRAPH-1

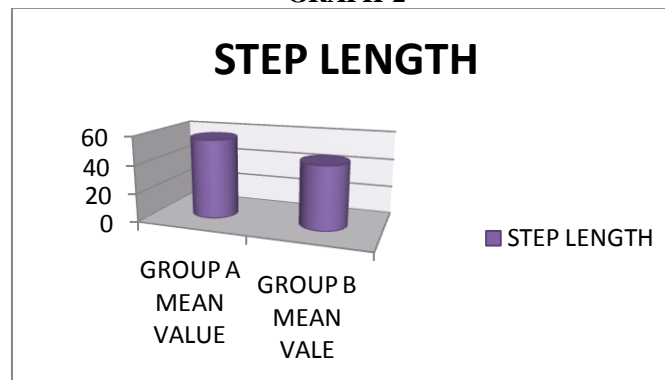


COMPARISON OF GROUP A [WEARING GROUND HEELED SHOE] AND GROUP B [WEARING HIGH HEELED SHOE] VALUES – IN STEP LENGTH

TABLE-2

S.NO	GROUP	MEAN VALUE
1	A	56.13
2	B	44.46

GRAPH-2

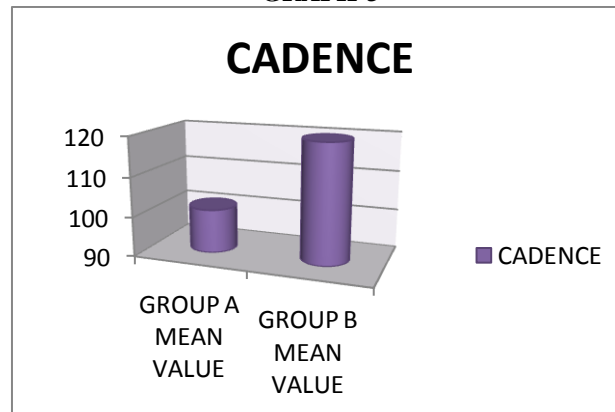


COMPARISON OF GROUP A [WEARING GROUND HEELED SHOE] AND GROUP B [WEARING HIGH HEELED SHOE] VALUES – IN CADENCE

TABLE-3

S.NO	GROUP	MEAN VALUE
1	A	101.06
2	B	119.86

GRAPH-3

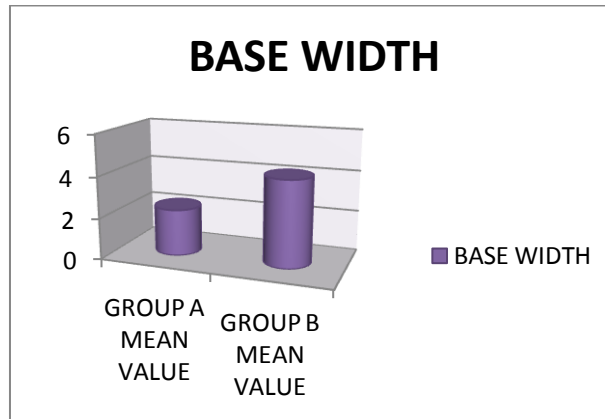


COMPARISON OF GROUP A [WEARING GROUND HEELED SHOE] AND GROUP B [WEARING HIGH HEELED SHOE] VALUES – IN BASE WIDTH

TABLE-4

S.NO	GROUP	MEAN VALUE
1	A	2.26
2	B	4.18

GRAPH-4

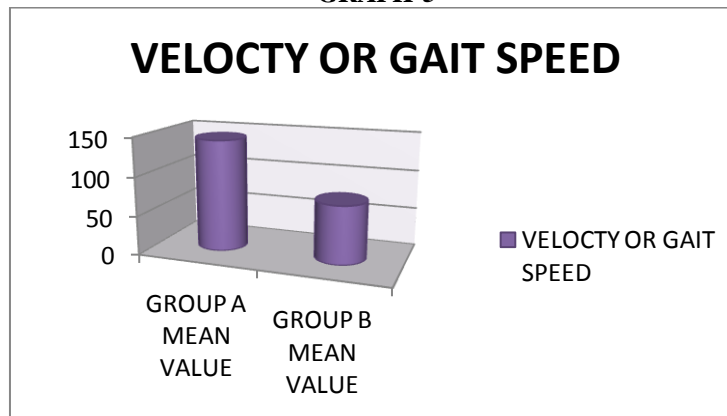


COMPARISON OF GROUP A [WEARING GROUND HEELED SHOE] AND GROUP B [WEARING HIGH HEELED SHOES] VALUES – IN VELOCITY

TABLE-5

S.NO	GROUP	MEAN VALUE
1	A	143.33
2	B	74.4

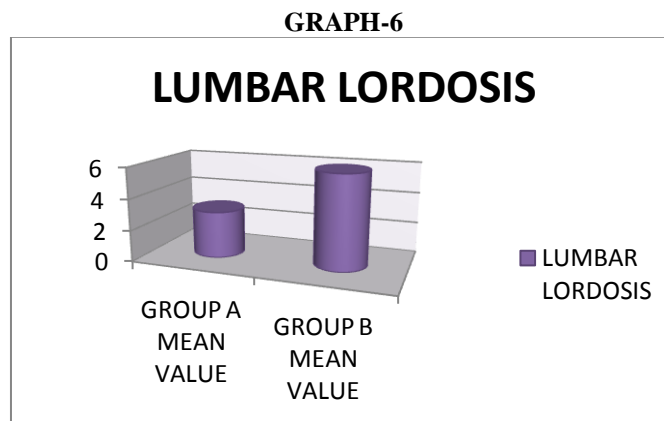
GRAPH-5



COMPARISON OF GROUP A [WEARING GROUND HEELED SHOE] AND GROUP B [WEARING HIGH HEELED SHOE] VALUES – IN LUMBAR LORDOSIS USING WALL TEST

TABLE-6

S.NO	GROUP	MEAN VALUE
1	A	2.99
2	B	5.98



III. Results

30 participants were involved in the study. Their age range and mean age were 18 to 25 years respectively. The physical characteristics of the participants on the gait and posture are shown in data analysis. The testing did reveal that significant difference on stride length, step length, cadence, base width, velocity and lumbar lordosis for high heeled shoe wearing females compare to the non-wearing high heeled shoe females. The result conclude that while comparing both **GROUP A**–wearing ground heeled females and **GROUP B**–wearing high heeled females mean values are there is significant difference in gait parameters and postural deviation of lumbar region such as decrease stride length and step length, increase cadence, base width widen, decrease velocity and excessive lumbar lordosis present in high heel wore females. **There is an impact on high heels wearers in gait parameters and postural deviations of lumbar region.**

IV. Discussion:

The primary role of shoes is to protect the foot and facilitate propulsion; however, fashion has strongly influenced the design of footwear throughout the ages. Thus, compromising the natural functioning of the foot.

This study aimed at determining the effect of high heel heights on gait parameters and postural changes amongst experienced wearers who are apparently healthy female undergraduate of Cherran's institute of health sciences.

The study revealed that as high heel height increases, the females have shorter stride length and step length, decreased velocity, base width wider and increases cadence and lumbar lordosis.

This may be attributed to a more cautious walking pattern so as to compensate for the elevation and forward shift of the centre of gravity, and altered biomechanics of the foot so as to prevent falls and foster postural stability.

H H MERRIFIELD revealed similar findings in this study of heel heights on gait parameters using 12 women's were compared during walking in flat shoes and in shoes with high heels. He conclude that heel shoes, especially high heeled shoes, causes a decrease in stride length and step length whereas there was a minimum change in the stride width and foot angle.

GEFEN ET AL compared the effects of different heel heights on gait parameters of wearing high heel shoes with low heel shoes or with bare foot. He noted that individuals on high heels shoes have shorter stride length and increased walking cadence.

OPILA CORREIA compared experienced and non-experienced wearers of high heels postulating that there would be a difference in the effect on posture between two groups. He conclude that prolonged use of shoes with increased heel height subject have an increased lordosis, cadence and decreased velocity and percentage stance time relating to age.

SILVA AM ET AL revealed similar findings in the study effects of high heeled shoes on body posture of adolescents using 20 subjects selected frequent use of high heeled shoes. He measures the body posture alignment for wearing high heel. He concluded wearing high heeled shoes in adolescent can lead to development of postural disorders among which stands out the forward head posture, lumbar hyperlordosis, pelvic ante version and knee valgus.

A significant difference in all selected gait parameters and postural alignments that wearing high heeled shoes prolonged period.

Our study also suggested that significant difference in the selected gait parameters and postural alignment such as decrease stride and step length and velocity, base width widen, increase cadence and lumbar lordosis wearing high heeled females compare to the non-wearing high heeled shoes.

When comparing both group mean values shows that there is a significant difference in gait parameters and postural deviations of lumbar region in wearing high heeled shoes compare to the ground heeled shoes.

When comparing both group mean values of **stride length** group A (115.67) > group B (100.93). For **step length** mean values of Group A (56.13) > Group B (44.46). For **cadence** mean values of Group A (101.06) < Group B (119.86). For **base width** mean values of Group A (2.26) < Group B (4.18). For **velocity** mean values of Group A (143.33) > Group B (74.4). For **lumbar lordosis** mean values of Group A (2.99) < Group B (5.98)

In this study, we realized after measurements taken there was a significant difference in gait parameters and postural deviations of lumbar region such as decreases stride length, step length and velocity, base width widen, increases cadence and lumbar lordosis wearing high heeled women's compare to the non-wearing high heeled women's and it leads to the wearing high heeled shoes changes the orientation of the lower extremity segments with particular changes occurring at the ankle and knee and also change in postural alignment particularly in lumbar region.

Hence we conducted about “ **A STUDY ON IMPACT OF HIGH HEELS OF GAIT PARAMETERS AND POSTURAL DEVIATION OF LUMBAR REGION IN YOUNG ADULT FEMALES**” is positive. So, we have to bring awareness for high heel wearing females, because it leads to muscle tightness [calf and back muscle], increase knee and hip pain, increase risk of OA, chronic low back pain.

We are adverse that to maintain comfort and reduce side effects associated with wearing high heel, females are advised to minimize putting on high heeled shoes.

V. Conclusion

In this study we concluded that comparing non-wearing and wearing high heeled females there is significant difference in gait parameters and postural alignment such as decrease stride length, step length and velocity, base width widen, increase cadence, and lumbar lordosis of wearing high heeled females than the non-wearing high heeled females, so as to achieve postural stability and kinematic adaptation.

It appeared that wearing heeled shoes changes the orientation of the lower extremity segments with particular changes occurring at the ankle and knee and also change in postural alignment particularly in lumbar region.

So, we have to bring awareness for high heel wearing females, because it leads to muscle tightness [calf and back muscle], increase knee and hip pain, increase risk of OA, chronic low back pain.

We are adverse that to maintain comfort and reduce side effects associated with wearing high heel, females are advised to minimize putting on high heeled shoes.

LIMITATION

- Duration of the study is only 6 months.
- The sample size of the study is small.
- Selected age group of 18 to 25 years females only.

RECOMMENDATION

- To maintain comfort and reduce side effects associated with wearing the high heel, females should be advised to minimize putting on high heeled shoes.
- Similar studies may also be carried out among elderly women.
- Similar studies can be done on increased sample size.
- Similar study can be done for longer duration.

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