Changes In Gait, Balance And Comfort That Is Felt In The Use Of Shoes With Height-Elevating Insole With A Height Of 5,7 And 9 Cm

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Abstract.
The Use of shoes with height-elevating insole lately has been rife in the community. Use sol high this can affect the function of static and dynamic body, where physical changes in the body. As a result, generate a posture which is not stable, not balanced, and less comfortable when used in daily activities. Have many kinds of shoes with high soles with distinctions high pedestal the soles of shoes that allow the existence of different effects for the body. Objective, Prove the change of gait, balance and comfort in use of the shoe with a height-elevating the insole at the height of 5, 7, 9 cm. Material and Methods, experimental Research with pre and post test design. Subjects are men aged 20-22 years with a Body Mass Index (BMI) normal. Thirty people who are willing to follow the study and meet the inclusion and exclusion criteria were divided randomly into 3 groups, group a 5 cm, 7 cm and 9 cm, which respectively amounted to 10 people. Each group performed a walk test to test gait, one leg stands and tandemstand to test the balance with the barefoot/barefoot, shoes with height- elevating the insole with the same high. Results, the Results of this study show a change in gait and balance that are significant between barefoot and wearing shoes high soles (p=0.005). But the difference between the shoes with the height-elevating insole with a height of 5, 7 and 9 cm is not significant on the parameters of gait (p=0.329) but there is a change of balance in between shoes high soles 5, 7, 9 cm on the parameters of the balance (p=0.000). Conclusion, there are differences in the balance and there was no difference in gait on the use of the shoe's height-elevating insole different (5, 7, 9 cm).

Keywords: *High Heels,Wedge, Non-Wedge,Gait,Balance.*

I. INTRODUCTION

Walking is a moving activity that involves both ekstermitas under alternately to move without losing stability and balance of the body. The repetition of this movement is defined as a cycle of gait. Gait is influenced by several factors, such as: the height of the right feet, the size of the right foot, and the type of the shape of the soles of shoes better in the shoe or the outside of the shoe. Control of balance is also one of the factors that affect the cycle of human walking [1].Control of balance is regulated by the central nervous system based on the information received by sensory systems of the body such as vision, proprioceptive sensation (muscular movement), and senses such as the vestibular system in the ear. The ability to maintain a stable balance in situations of static and dynamic required as a condition of increasing function daily activities. Eksteroreseptor and propioreseptor on the feet plays an important role in the control of balance. The central nervous system receives impulses from the receptors asendens sensory of legs to maintain balance of the body [2].The shoes are created with functions that are focused to facilitate the cycle of walking (gait) [1]. In addition, the shoe also serves to support the improvement of balance, reflex, and the muscles on the ankle so as to prevent the risk of falling or losing balance. But today shoes have become one of the fasion in the use of the community in everyday life. The shoes have many types with wide and high pedestal foot different, one is high heels [3].High heels were first introduced in the beginning of the year 4000SM and only worn the men at the slaughterhouse the animals. In the 16th century high heels have been used by aristocrats, members of royal and aristocratic, to look masculine and powerful [4].

However, at the present time, women have been more dominant in the use of high- heeled shoes because it has become one of the fashions in dress. While in men, especially the boned short prefer to use shoes with height elevating sole. Use HEY have more and more because it can help men who boned short to look taller [1]. With increasing height because of the use of shoe sole height, may also increase the sense of confidence and improve the ability of interaction with other people. This trend has attracted the interest and research that is consistent on the use and effects of HEIs [1].On the use of shoes with high soles can affect

the function of the static and dynamic of the body [5]. Like when heel height increased, the curvature of the lumbar spine decreased, resulting in posture is not stable and gives an additional load on the lumbar spine. This mechanism can lead to LBP with the increase of fatigue in the muscles around the lumbar spine [1].Based on the research of So-Yeon Park et al., namely on the use of shoes with high soles increase the muscle activity around the ankle, such as soleus, tibialis anterior, gastrocnemius and peroneus longus [1]. The gastrocnemius muscle and peroneus longus more prone to fatigue than other muscles. The increase in muscle activity that is not efficient is trigger the occurrence of phase fatigue faster, which cause an imbalance on the user, thereby increasing the risk of falling when walking or standing [1]. Stolwijk et al. investigate the changes in pressure plantar depending on the presence or absence of sol among the 204 subjects who complain of leg discomfort [6].Although the study of the sol has increased, few studies have determined the changes in the body in accordance with the height of the HEIs. Therefore, this study is to investigate changes in gait, balance and comfort that is felt in the use of shoes with height elevating insole (HEY) on the height 5.7 and 9 cm.

Objectives of the study

1. Determine changes in gait, balance and comfort that is felt in the use of the shoe with a height-elevating insole (HEY) on the height 5.7 and 9 cm.
2. Determine changes in the parameters of gait (step length, stride length, cadance, and gait speed) on the use of shoes with height - elevating insole (HEY) on the height 5.7 and 9cm.
3. Knowing the changes in the parameters of the balance of one leg stance test and tandem stance on the use of shoes with height-elevating insole (HEY) on the height 5.7 and 9cm.
4. Determine changes in the parameters of gait (step length, stride length,
5. Cadance, and gait speed) on barefoot, the use of shoes with height-elevating insole (HEY) at the height of 5, 7 and 9cm.
6. Knowing the parameter changes the balance of one leg stance test and tandem stance on barefoot, the use of shoes with height - elevating insole (HEY) at the height of 5, 7 and 9cm.
7. Determine changes in the parameters of the visual analog scale (VAS) on barefoot, the use of high heels and shoes with height - elevating insole (HEY) at the height of 5, 7 and 9cm.

II. METHODS

The research is experimental research design with pre test and post test design. The group will be divided into groups of height - elevating insole (X1). X1: Participants performed a pre-test (01) examination of gait, balance and comfort without the use of footwear, next the post- test (02) examination of gait, balance and comfort with the using the shoe height- elevating insole (HEY) size 5, 7 and 9 cm.The target population is the entire students of the University of Prima Indonesia. Population affordable is a student basketball team of the University of Prima Indonesia. The Study sample was male gender aged 20-22 years, have a shoe size 40-44 and normal BMI and a large sample of this research is 30 people.The Research variables used in this study is the independent Variable. The independent variable in this study is the shoe with a height-elevating insole (HEY) on the high 5,7 and 9 cm. The dependent variable, the dependent Variable in this study is the change in the gait, the balance and the comfort level of the use of shoes.

III. RESULT AND DISCUSSION

Results Of Test the Data for Normality Test Shapiro-Wilk

Table 4.1. Results of Test the Data for Normality Test Shapiro-wilk

F	Value P
Gait	
Step Length (cm)*	0.531
Stride Length (cm)*	0.403
Cadance (step / minutes) **	0.003
Gait Speed (m/s) *	0.214
Balance	

OLS the right foot eyes open (seconds) *	0.444
OLS left leg eyes open (seconds)*	0.284
OLS the right leg close your eyes(seconds)*	0.040
OLS the left leg close your eyes (seconds)**	0,928
Tandem right (seconds)**	0.000
Tandem left (seconds)**	0.000

* Data is analyzed with the test of the parametric form of One-Way Anova test.
**Data is analyzed with statistical non-parametric form of The Kruskal-Wallis test

From the data of table 4.1. it can be seen that of the parameters of gait are all part of the parameters of gait normally distributed except the parameters of the cadence. While on the parameters of the Balance of the OLS right leg eyes open, OLS left leg eyes open, and OLS right leg close your eyes normally distributed, while the rest of the parameters of the balance in the form of OLS left leg-eyes closed, tandem right leg, and tandem left foot distributed not normal ($p=0.003 < 0.005$). Then begins with a descriptive analysis against each of the parameters of the gait and balance of each high HEY, and found the following results.

Table 4.2. Overview of Parameters of Gait and Balance on the Use of Shoes with HEY 5 cm, 7 cm, and 9 cm

Parameters	**5 cm**	**7 cm**	**9 cm**
	Gait		
Step Length (cm)*	51.90 ± 6.56	49.10 ± 4.36	44.90 ± 7.33
Stride Length (cm)*	107.70 ± 11.74	100.80 ± 8.55	92.90 ± 15.26
Cadance (step / minutes) **	8.50 (1.00)	8.60 (2.25)	9.00 (1.25)
Gait Speed (m/s) *	5.00 ± 1.20	4.30 ± 0.95	3.41 ± 0.83
alance			
OLS the right foot eyes open (seconds) *	23.47 ± 12.04	22.59 ± 11.45	21.45 ± 12.98
OLS left leg eyes open (seconds)*	22.47 ± 4.21	21.35 ± 3.78	20.58 ± 7.70
OLS the right leg closes your eyes (second)*	14.62 ± 6.24	13.91 ± 7.74	12.87 ± 7.66
OLS the left leg close your eyes (second)**	15.05 (10.02)	13.36 (2.95)	11.09 (13.80)
Tandem right (second)**	60.00 (0.00)	60.00 (0.00)	55.23 (13.94)
Tandem left (second)**	60.00 (0.00)	60.00 (0.00)	60.00 (12.24)

* Data is analyzed with the test of the parametric form of One-Way Anova test.
**Data is analyzed with statistical non-parametric form of The Kruskal-Wallis test

From the data in table 4.2 it can be seen that of each component found the picture in the form of:

1. *Step Length*

The average value of the Step length use HEY 7 cm with agait speed of 4.30 m/s and at most is on the respondents who use the HEY of 5 cm is 5 m/s. OLS Right Leg Eyes Open of the third HEY of the closest is 44.90 cm on HEY 9 cm, 49.10 cm on HEY 7 cm, and most far is HEY 5 cm so far 51.90 cm.

2. *Stride Length*

The average value of the Stride length of the third HEY of the shortest is on HEY 9 cm by 92.90 cm, then the 100.80 cm on HEY 7 cm, and most long distance is HEY 5 cm 107.70 cm.

3. *Cadance*

Candance most is on HEY 9 cm 9 steps per minute, then followed by HEY 5 cm as much as 8.60 steps per minute and the least is HEY 5 cm is only 8.5 steps per minute.

4. Gait Speed

Gait speed is most quickly found in respondents who use HEY 9 cm 3.41 m/s followed by the respondents who use HEY 7 cm with a gait speed of 4.30 m/s and at most is on the respondents who use the HEY of 5 cm is 5 m/s.

5. OLS Right Leg Eyes Open

The OLS on the right foot with the eyes open indicates that the respondents who use HEY 9 tend to have OLS that fast, which is 21.45 seconds, while the respondents who use HEY 7 cm have OLS of 22.59 seconds and a has a value of OLS is respondents who use HEY 5 cm is 23.47 seconds.

6. OLS Left Leg Eyes Open

OLS on the left leg with the opened eye indicates that the respondents who use HEY 9 tend to have OLS that fast, which is 20.58 seconds, while the respondents who use HEY 7 cm have OLS of 21.35 seconds and a has a value of OLS is respondents who use HEY 5 cm of 22.47 seconds.

7. OLS Right Leg Eyes Closed

The OLS on the right foot with the eyes closed shows that the respondents who use HEY 9 tend to have OLS that fast, which is 12.87 seconds, while the respondents who use HEY 7 cm have OLS of 13.91 seconds and a has a value of OLS is respondents who use HEY 5 cm of 14.62 seconds.

8. OLS Left Foot Eyes Closed

OLS on the left leg with the opened eye indicates that the respondents who use HEY 9 tend to have OLS that fast, which is 11.09 seconds, while the respondents who use HEY 7 cm have OLS amounted to 13.36 seconds and a has a value of OLS is respondents who use HEY 5 cm of 15.05 seconds.

9. Tandem Right Foot

Time tandem right foot almost the entire respondents who use the HEY high 5 cm and 7 cm is 60 seconds, while the respondents who use HEY 9 cm showed a tendency time tendem of 55.23 seconds.

10. Tandem Left Foot

Time tandem left foot all the respondents have the tendency of time tendem of 60 seconds. However, in the group of respondents who use HEY 9cm more varied it is seen from the value of the IQR are presented. After analysis descriptive analysis is then followed to assess the differences in the parameters of gait and balance are affected by the high HEY. As for the results of the analysis are shown in the table below.

Table 4.3. Comparison of Parameters of Gait and Balance on the Use of the Shoes HEY 5 cm, 7 cm and 9 cm.

Parameters	Value P
Gait	
Step Length*	0.056
Stride Length*	0.038
Cadance**	0.302
Gait Speed*	0.005
Balance	
OLS left leg eyes open *	0.933
OLS the right foot eyes open *	0.745
OLS the left leg close your eyes*	0.862
OLS the right leg close your eyes**	0.802
Tandem right **	0.235
Tandem left **	0.089

* Data is analyzed with the test of the parametric form of One-Way Anova test.

**Data is analyzed with statistical non-parametric form of The Kruskal-Wallis test

From the data table above can be seen high HEY statistically show differences on some parameters of gait, i.e., stride length and gait speed, it is seen from the value of $P < 0.05$. While on the parameters of balance, high HEY do not give influence for staistik on each of such balance. The analysis then continued by comparing the value of the gait and balance against each high HEY before and after use HEY.

Table 4.4. Comparison of Gait and Balance Before (Pretest) and After (Posttest) Using HEY 5 cm, 7 cm, and 9 cm

HEI	Parameters	Pretest	Posttest	Value P
5 cm	Gait*	45.66 ± 4.11	43.27 ± 4.58	0.329
	Balance **	60.00 (0.00)	33.18 (5.72)	0.005
7 cm	Gait*	47.16 ± 5.42	40.70 ± 3.47	0.117
	Balance **	60.00 (0.00)	31.78 (5.72)	0.005
9 cm	Gait*	47.76 ± 3.14	37.58 ± 5.58	0.386
	Balance **	60.00 (0.00)	30.02 (5.90)	0.005

* Data is analyzed with the test of the parametric form of One-Way Anova test.
**Data is analyzed with statistical non-parametric form of The Kruskal-Wallis test

From the data in the table above it can be seen that of the gait of each high HEY no one shows the differences in Gait before and after use HEY. But in each group high HEY statistically experiencing changes in the parameters of the balance before and after use HEY, this is reflected from P-value smaller than 0.05 (P-Value = 0.005).

The difference in the Gait Without the Use of Shoes and With Shoes HEY (Height Elevating Insole)

From the results obtained, it can be seen that there is a change gait shoes with HEY 5cm, 7cm and 9cm are not significant among the 4 parameters of gait, namely: step length, stride length, cadance, and gait speed.From the results it can be seen that the gait of the largest generated by the parameter stride length of 107.70, while the gait of the smallest produced by the parameters of the gait speed that is equal to 4.30.With the use of shoes HEY can increase increased lumbar lordosis or curvature of the lumbar spine. So can affect of 4 parameters. With increased lordosis of the lumbar prolonged can risk increasing the occurrence of low back pain et. HNP.

The difference of Balance Between Not Using Shoes with the Shoes HEY (Height Elevating Insole)

From the results obtained, it can be seen in table 4.4 that there is a demolition of the balance with the shoes HEY 5cm, 7cm and 9cm whice significant among the parameters of the balance, namely: OLS Right Leg Eyes Open, OLS Left Leg Eyes Open, OLS Right Foot Eyes Closed, OLS Left Foot Eyes Closed, Tandem Right Leg and Tandem Left Foot (p=0.000 < 0.005).Shoes HEY can improve muscle activity. On the running style / gait is normal, the muscles work synergistically, but in the use of high heels, there is increased use of energy which can increase muscle fatigue. The muscles of the lower extremities increased work because plantarfleksi excess while using the high heels.According to the study of the influence high shoe soles against the pressure distribution of the plantar when walking and running show that the higher the sol darisepatu, the pressure of the front foot/forefoot is also reduced.

IV. CONCLUSION

Based on the results of research and analysis of data about changes in gait and balance on the use of shoes with height-elevating the insole at the height of 5cm, 7cm and 9cm on the students of the University of Prima Indonesia can be concluded :

1. There are changes in the value of gait shoes with the height-elevating insole in between the 4 parameters of step length, stride length, cadence and gait speed, in which the value of the gait shoe height-elevating the insole of the largest produced by the parameters of stride length, while the value of gait, the smallest is produced by gait speed.
2. No difference in gait that significant in between the to-3 size high shoes, in which the value of the gait shoe height- elevating the insole of the largest produced by high boots 3 cm, while the value of gait, the smallest is produced by high shoes 5 cm.
3. There is a difference balance which is significant in between the 6 parameters of the one leg stance right leg eyes open, one leg stance left leg-eyes closed, one leg stance right leg-eyes closed, one leg stance left lid eyes, tandem stance and right tandem stance left (p = 0.000 <0.05) where the value of the balance of

the shoes height- elevating the insole of the largest produced by the parameters of the tandem stance right, while the value of the balance of the smallest produced by the parameters of the one leg stance left foot close your eyes.

4. There is a difference in the balance of the shoes height-elevating insole that significant in between the to-3 size high shoes, in which the value of the balance of the shoes height-elevating the insole of the largest produced by the high shoes of 5 cm, while the value of the balance of the smallest produced by high boots 3 cm.

5. There is a difference in the value of gait a significant difference between the pre- test to post - test for shoes height- elevating the insole in which the value of the mean gait posttest shoes height- elevating insole in high 9cm low, followed by a posttest shoes height- elevating the insole in height 5cm and 7cm, which is also lower than the mean value of the gait pre-test.

6. There is a difference in value balance significant between the pre - test to post-test for shoes height-elevating the insole in which the mean value of the balance of the post-test of the shoes height-elevating insole in high 9cm low, followed by post-test shoe height - elevating the insole in height 5cm and 7cm, which is also lower than the mean value of the balance of the pre-test.

V. RECOMMENDATION

Given the results of the research is not maximized, then with this conveyed the suggestion that similar research can be carried out with a population of more as well as with the methods or use tools that are more modern for the measurement of gait and balance.

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