



# Effect of Forward and Backward Walking on Gait Among Normal Individuals: An Experimental Study

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## Introduction

Walking is human's most basic motion and it is beneficial in improving health. Walking exercise has diverse effects so that feet are called the second heart and this exercise has direct impact on the improving cardiovascular endurance and also helps in developing leg muscles. (Backward walking causes both isometric and concentric activity of the quadriceps femories muscle, while the muscle's action during forward walking is mainly eccentric.<sup>1</sup> Backward walking is an activity that results in joint kinematic patterns and are different from those experienced during forward walking.) Forward and backward walking has beneficial results through gait training so treadmill is one of the assistive devices to improve gait training. Repetitive gait training improves gait speed. Among the possible training elements, backward gait training on a treadmill occurs in a direction that is opposite to forward gait training, but is regulated by the same central pattern generator mechanism; therefore, it might be presented as a therapeutic intervention method for improving forward gait ability.<sup>2</sup> Few studies show that backward walking was effective to stimulate muscles of lower limb compare to forward walking. Previous studies shows that forward walking helped to improve gait so in this study we are focusing on effect of forward and backward walking on gait among normal healthy adults.

## Methodology

In this study, 30 participants were recruited only after approval of institutional ethical committee. 15 subjects were assigned to group A received forward walking on treadmill and 15 subjects assigned to group B received backward walking on treadmill. The participants were screened and recruited on inclusion and exclusion criteria. Inclusion criteria were both male and female with age of 30yrs to 45 yrs and normal BMI - 18.9-24.9 kg/m<sup>2</sup>. Recent orthopedic surgeries, recent cardiac and pulmonary surgeries, any systemic illness interfering normal walking of individual, any orthopedic or neurological conditions that affect walking were excluded. Written informed consent was taken. In this study participants divided into 2 groups. Group A was given forward walking and group B received backward walking training. Participants walked for 1 min to determine their natural gait velocity before experiment. Participants walked barefoot on treadmill and average gait velocity was 3km/hr on a 10% Incline. Participants of both groups walked for 10min, five times a week for 6 weeks. Before walking 5 minutes warm up exercises and after intervention 5 minutes cool down exercises given. Pre and post intervention speed assessed using 10 meter walk test.

## Results

Statistical analysis SPSS (version 23) software used for data analysis . 15 subjects taken for forward walking, 9 (60%)

were male and 6 (40%) were female.

Table 1 Forward Walking			
Forward walking	Mean & Std.	r value	p value
Pre Treatment	1.388 ±0.11098	0.988	< 0.001
Post Treatment	1.414±0.12111		

<b>TABLE 2. BACKWARD WALKING</b>			
<b>Backward walking</b>	<b>Mean &amp;Std</b>	<b>r value</b>	<b>p value</b>
<b>Pre Treatment</b>	1.368±0.08526	0.912	< 0.001
<b>Post Treatment</b>	1.472±0.10685		

For backward walking group, the demographic data analyzed shows that among the 15 subjects taken for backward walking, 10 (60%) were male and 5 (40%) were female. On analyzing the data for forward walking i.e. control group (Table 1), the results indicated that the mean score for pre treatment was 1.388 and for post treatment the mean value was 1.414. the r value shows positive correlation between the pre treatment and post treatment scores. The results also indicate the significant difference between the two scores for Forward walking control group. On analyzing the data for backward walking i.e. experiment group (Table 2), the results indicated that the mean score for pre treatment was 1.388 and for post treatment the mean value was 1.414. The r value shows positive correlation between the pre treatment and post treatment scores. The results also indicate the significant difference between the two scores for backward walking control group. Table 3 Shows that there is no significant difference between the post treatment groups of Forward and backward walking with p value 0.08 (p value <0.05 is considered significant) . This indicates that both the treatments are equally effective.

<b>Table 3</b>			
<b>Groups</b>	<b>Mean &amp;Std</b>	<b>T value</b>	<b>P value</b>
<b>Forward walking</b>	1.414±0.12111	- 1.391	0.08
<b>Backward walking</b>	1.472±0.10685		

## **Discussion**

The Backward walking exercise has been a point of interest in many studies until now. This exercise can help minimize the burden on joints and increase muscle strength in the lower limbs in normal individuals. In addition, this exercise does not cause adverse effects on the body through the stimulation of the major muscle in a rhythmic and dynamic fashion. Similar is the case for Forward walking on an inclined surface.<sup>3-4</sup>

In this study, investigation was done for the effects of forward and backward walking on treadmill with inclination in normal adults aged between 40-59 years. The findings indicate that both forward walking and backward walking have significantly positive effects in the subjects taken. In contradiction to this, a study by Nadeau S et al. reported that backward walking reduced

step length and improved gait speed, indicating that it was an effective to increase the endurance of lower limbs . The result findings also indicated that both the walking patterns were equally effective when compared together. The mechanism of walking for backward walking suggests that it has less impact on the kneecaps and patello-femoral joints as the metatarsal joints come in contact with the surface first. However, the forward walking has a relatively greater impact on the knee joints and the ankles. This may be due to the fact that walking is only possible with flexion of the knee or hips because ankles show minor movement.<sup>5</sup> Even though backward walking is not practiced in day-to-day life, it is effective in stimulating muscles of the knee joints and quadriceps in a more balanced manner. The results of this study may be susceptible to the selection of individuals, their age, their gait patterns and their balance. According to another study by Osullivan SB, Schmitz TJ (2006) backward walking stimulated muscles in the lower limbs and showed higher energy consumption in the lower limbs when combined with knee flexion and hip extension. Another study by Hwan-Hee Kim

and Je- Myung Shim et. al. (2016) verified that Backward Walking was effective for increasing step time, step length and mid stance.<sup>6</sup>

## Conclusion

In this study, there was no significant difference found between the Forward walking and backward walking. Therefore we can conclude that both forward walking and backward walking are equally effective.

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