

# Evaluating the depression status following backward walking exercise in diabetic neuropathy patients

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## Abstract

The incidence rate of psychological depression is commonly grown among patients with diabetic neuropathy (DN). This pilot retrospective study aims to assess the effects of backward walking exercise (BWE) on depression condition in patients experiencing DN. This pilot retrospective study included 27 patients who clinically suffered from moderate depression related to DN between August 2017 and December 2018, and their mean age was 43.5±6.4 years. They were equipped for a program of backward walking exercise for six weeks, quartile weekly, and lasting for 50-60 minutes. The depression level was evaluated before and after backward walking exercise program utilizing Hamilton depression rating scale (HRS). The results showed that six-week backward walking exercise results in a significant reduction in HRS in DN patients ( $p<0.001$ ). The percentage of changes of HRS was 32.9% at the end of the exercise program. These findings provided that the backward walking exercise has a beneficial influence on depression status among diabetic patients, especially who experiencing DN.

**Keywords:** Diabetes, Neuropathy, Depression, Backward walking exercise, Proprioception

## INTRODUCTION

The frequency rate of depression condition was grown among diabetic individuals with approximately two-fold risks of non-diabetic peers [1]. Previous studies have confirmed that diabetes mellitus (DM) increases the prevalence of depression for about 24% [2]. The incidence of depression condition is commonly increased in chronic diseases and extremely elevated in diabetic disease which affects behavioral lifestyle [3]. Vascular complications are numerous in DM such as neuropathy, nephropathy, and retinopathy [4] due to microcirculation impairment [5].

Strong association was detected between diabetic neuropathy (DN) and depression manifestations related to symptomatic DN such as diabetic foot, leg pain, and body instability [6]. It was stated in a study that the depressive condition stands for a considerable co-morbidity of DN-related pain [7] according to the severity level of pain [8]. Although depression conditions may be related to other common co-morbidities which are associated with DM [8, 9], it is not constantly considered when examining the association between DN and depression disorder.

Backward walking exercise (BWE) is an important modality of proprioception exercise programs which is preferred than

forward walking in plantar pressure distribution and enhancing coordinative and balance abilities. BWE may also improve neural performance, decrease pattern of foot contact and stride length which consequently diminishes contact-impact force [10]. Moreover, it was previously documented that BWE has some benefits such as reducing the ground reaction force, lengthening of hamstring muscle related to limited knee joint mobility, and enhancing proprioceptive equilibrium during daily activities [11].

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Therefore, BWE may provide lower limb stability, balance, strength, and decrease DN symptoms. Consequently, we have proposed this study to assess the effects of backward walking exercise on depression condition in patients experiencing DN with hypothesis that six-week BWE may improve depression status among DN patients and improve their quality of life.

## MATERIALS AND METHODS

### Study design

This study was a pilot retrospective study. It was performed on 27 DN patients experiencing moderate depression in the outpatient physiotherapy clinic, Cairo University Hospitals between August 2017 and December 2018. This pilot study was approved by the institutional review board according to Helsinki Declaration 1975.

### Subjects

Twenty-seven patients have been diagnosed with diabetic neuropathy and moderate depression following clinical and laboratory assessments, their age range was 37-50 years. They were referred by psychiatric and diabetic physicians to outpatient physiotherapy clinic. Patients were excluded from the study if they had mild or severe depressive disorder, uncontrolled hyperglycemia, antidepressant medications, and any restrictions affecting physical exercise. Each patient was informed about the details of the study procedures and instructed to sign a written consent form.

### Materials

The depression level has been assessed using valid Hamilton depression scale (HDS) pre- and post-six weeks of BWE program. HDS is a 17-item valid and reliable scale. Each item is scored 0-4. Total score is classified into normal (<10), mild (10-13), moderate (14-17), and severe (>17) [12, 13].

### Procedures

#### Assessment

Demographic data and clinical characteristics have been collected from patients' files and have been entered into Microsoft Excel 2010 and analyzed using SPSS version 25. HDS was assessed before starting the BWE program and reassessed after six weeks after finishing the study intervention.

#### BWE program

The study participants were recruited to BWE program which detailed as; 50-meter corridor, two-side landing strip zones with a length of 10-meter and width of 5-meters between the 2 zones which were spotted utilizing a colored sticky tape. The patient was instructed to walk barefoot normally in a backward direction for 50-60 minutes, quartile weekly, for six weeks duration.

### Statistical analysis

Data were collected and analyzed consuming SPSS version 23 (IBM Corp., Armonk, NY, USA). Paired t-test was executed to evaluate the pre- and post-intervention changes in the HDS. Data were detailed as mean  $\pm$  standard deviation. The significance level was considered at p-value<0.05.

## RESULTS

Of referred 32 patients, 27 patients have regularly attended the study program and five have attended 50 % of the interventional sessions of BWE program. Table 1 shows demographic and clinical characteristics of the 27-patient (18 males and 9 females) with mean age of  $43.5 \pm 6.4$  years. All participants were non-smokers. 6 patients were insulin-dependent DM and 21 were non-insulin dependent DM. Their mean body mass index (BMI) was  $28.7 \pm 4.2$  Kg/m<sup>2</sup>. Mean glycated hemoglobin (HbA1c) was  $7.3 \pm 1.8\%$  and mean HRS was  $15.5 \pm 1.3$  reflecting that the study participants were suffering from moderate depression.

**Table 1.** The baseline and clinical characteristics of the study participants

Variables	(n=27)
Age	$43.5 \pm 6.4$
Gender (M/F)	18/9
BMI (Kg/m <sup>2</sup> )	$28.7 \pm 4.2$
Duration of diabetes (years)	$9.7 \pm 4.5$
Insulin dependent DM n(%)	6(22)
Non-insulin dependent DM n(%)	21(78)
HbA1c (%)	$7.3 \pm 1.8$
HRS	$15.5 \pm 1.3$

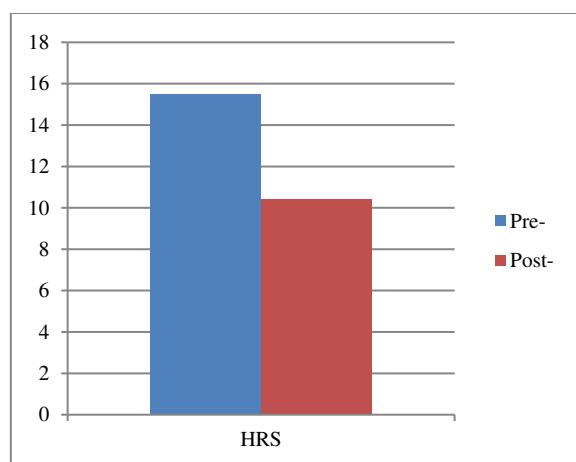
BMI: body mass index; DM: diabetes mellitus; HbA1c: glycated haemoglobin; HRS: Hamilton depression rating scale.

As explained in Table 2 and described in Figure 1, using of paired t-test showed a significant reduction of HRS from  $15.5 \pm 1.3$  pre-intervention to  $10.4 \pm 0.9$  post-intervention with ( $p < 0.001$ ). Comparison between baseline HRS and post-six weeks intervention showed that the percentage of changes was 32.9%.

**Table 2:** The changes in mean values of HRS between pre- and post-six weeks intervention

HRS	(n=27)
Pre-	$15.5 \pm 1.3$
Post-	$10.4 \pm 0.9$
P-value	<0.001
% of changes	-32.9%

Significant at p-value<0.05; HRS: Hamilton depression rating scale.



**Figure 1:** Pre-Post changes of HRS

## DISCUSSION

This retrospective study aims to assess the effects of backward walking exercise on depression condition in patients experiencing DN with hypothesis that six-week BWE may improve depression status and quality of life among DN patients. The findings confirmed our hypothesis and showed a significant reduction of HRS from  $15.5 \pm 1.3$  pre-intervention to  $10.4 \pm 0.9$  post-intervention with ( $p < 0.001$ ). The comparison between baseline HRS and post-six weeks intervention showed reduction around 32.9% of the HRS score.

Different physiological mechanisms could clarify that backward walking exercise enhances balance, stability, and proprioceptors of the distal extremities. Similar to our findings, a prior study has approved that proprioceptive exercise combined with traditional physical therapy program improve balance and proprioceptive sensation [14]. Sensory dysfunctions of the feet may lead to balance disturbance and posture instability. The enhancement of proprioceptive sensation may improve posture stability and body balance which improves somatosensory integrations [15,16] and consequently improves psychological status and reduces depression condition.

Many studies have approved that exercise training may improve psychological conditions [17-19], quality of life [20,21], aerobic capacity, and liver functions, and reduce blood glucose levels in diabetic patients [22-24].

BWE should be involved in rehabilitation program as a simple, low-cost, and safe modality in enhancing balance and quality of life through preventing falls risks during daily activities in DN patients.

This work has strengths for clinical practitioners joining the physiotherapy team. Firstly, it is very critical to be aware that disturbed psychological status can affect our interventional program. Secondly, it is satisfying for rehabilitation team to understand that proprioceptive

training can positively affect psychological domains. Finally, the backward walking exercise may reduce depression severity among DN patients. On the other hand, our retrospective study has some limitations. Our study has a small sample size and lacked for control group which affect the generalization of the study findings.

## CONCLUSIONS

Based on the study findings, the backward walking exercise has a beneficial effect on depression condition among diabetic patients, especially among experiencing diabetic neuropathy. Future studies may assess the effect of backward walking exercise on other health problems such as muscle fatigability, pain, and anxiety.

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## Competing interests

The authors declare that no competing interests to disclose.

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