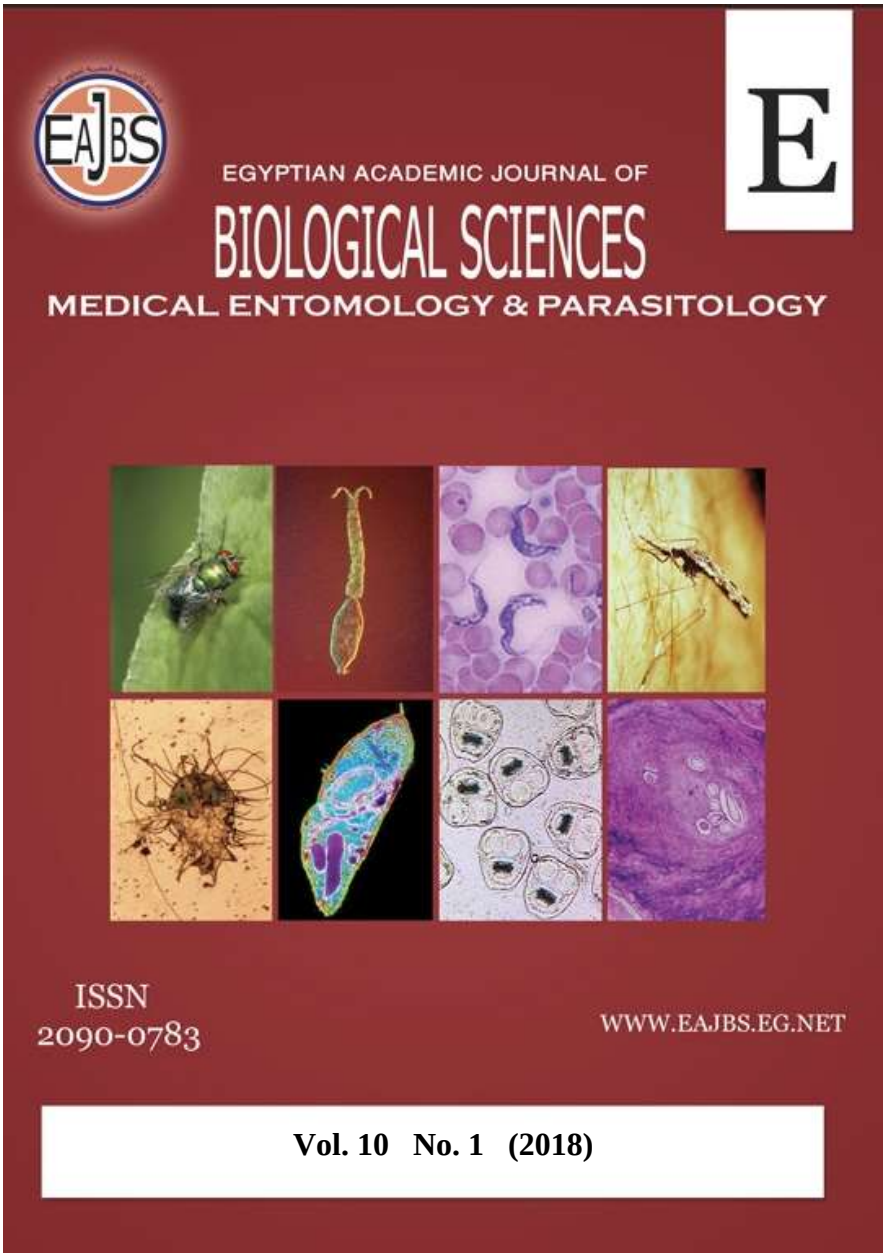

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The Effect of 8 Weeks of Dynamic Neuromuscular Stability (DNS) Exercises on the Performance and Quality of Men and Women's Life with Apoplexy (Stroke)

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ABSTRACT

Introduction: The instability in movement is one of the most important disorders after stroke. Dynamic Neuromuscular Stability (DNS) exercises can rebuild movement patterns and create postural stability, gravity overcoming, and rising up in these patients by simulating and recalling the growth patterns of a healthy baby in people with neuromuscular issues.

Methodology: The present research is semi-experimental with random sampling. Thirty patients with stroke were randomly divided into two experimental (n = 15) and control (n = 15) groups based on their inclusion criteria. The quality of life (SF-36) and performance (Berg Balance Scale (BBS) Test) of samples were measured. DNS exercises were performed in the experimental group for 8 weeks (three sessions per week). The control group did not do the exercises and continued their daily routine activities. The post-test was repeated after eight weeks, similar to the pre-test.

Results: There was a significant improvement in performance of samples and some indicators of quality of life (role disorder due to physical health, energy and fatigue, emotional well-being and pain). There was no significant difference in other indicators of quality of life (physical function, role disorder due to emotional health, social function and general health).

Discussion and conclusion: DNS exercises were caused an improvement in the performance and quality of life of patients with stroke by calling the motor developmental patterns of healthy infants from birth to one year of age.

INTRODUCTION

Motor issues are one of the most important symptoms of brain damage in stroke patients. The most common stroke disorder is a half-body sensation (hemiplegia). The severity and type of hemiplegic disorder depends on the location and extent of the lesion. Postural instability and falling is one of the most common problems in patients suffer from stroke (Brown *et al*., 2002). The main cause of the fall in patients with stroke is disorder in postural stability. Fractures, illness, death, major economic losses, and social problems are the symptoms of these patients' falling down (Nelles, *et al*., 2001). Opara and Jaracz (2010) have shown that the quality of life of these patients greatly decreases with the loss of autonomy of stroke patients and their dependence on others, as well as the pain, health problems, disability in everyday life and social problems (Opara and Jaracz, 2010).

Finding solutions to motor problems, health, postural instability, and poor quality of life for these patients are essential. Poor motor control and inadequate posture stability can increase future problems for these patients. Unbalance and increased risk of falling in this cortex, which are mostly elders, can cause countless losses (Januário *et al*., 2010). Dangers of falling out, such as fractures, physical and psychological imbalances (Gillen, 2015), high medical costs (Gillen, 2015) and threats to the family foundation (Skidmore *et al*., 2015), and finding strategies that can improve postural and improve the motor's performance and quality of life in these patients are essential. Numerous studies show the effectiveness of sport exercises in improving strength, endurance, stability and motor control in patients with cerebral stroke (Gordon *et al*., 2004; Eng *et al*., 2010). Eng (2010) said that the exercising fitness and dynamic programs can help to improve the physical and cognitive abilities of patients with stroke and reduce the risk of secondary complications such as falling, fractures and heart disease (Eng *et al*., 2010).

The brain tissue which goes away during the stroke does not get survived, but the human brain has the ability to create new paths and paths between the remaining neurons (Brain Nerve Cells); That is, synapses or connections between the new neurons are formed and a new balance is established for the continuation of brain activity (Sibley *et al*., 2015). One of the ways of forming these new neurotransmitter pathways is exercise, especially sport exercises, suggested by the researchers (Peterson and Renstrom, 2016).

The model of Panjabi shows that posture stability is mainly provided by the mutual and related interactions between the three nervous systems (central nervous system), active (muscle) and inactive (joints and bones) (Panjabi, 1992). It is obvious that concentrating on muscles, joints and bones, without taking into account the valuable motor control generated by the central nervous system, will not significantly improve postural stability and control. This clarifies the need for brain exercises to improve the motor control pattern (Frank *et al*., 2013). According to the Punjabi triangular model in preserving postural stability and the importance of central nervous system exercises in motor control, a model of postural stability exercises called Dynamic Neuromuscular Stability (DNS) exercises were proposed. These exercises were first designed by Pavel Kevlar in 2013. DNS exercises perfectly coordinate between muscles and regulate intra-vaginal pressure through the central nervous system. These exercises help to stabilize the inner body in order to optimize the body's motor system before and after the injury and affect the function of the individual. DNS exercises are designed based on the principles of growth (developmental) kinematics (Kobesova and Kolar, 2017). According to the growth kinematics theory, the growth pattern of human motor activity in childhood is genetically predetermined and predictable. This pattern or movement program grows in the central nervous system and enables the child to control the state of the body, to achieve a static state, unlike gravity, and performs targeted movements through muscular activity (Brown *et al*, 2002). The basis of DNS exercises is based on the healthy baby's positions and motor patterns. Basically, in the DNS exercises, each baby's growth position is an exercising position. Each exercise should follow a series of principles that include: 1. Proper respiratory pattern and intra-abdominal pressure adjustment.

2. Stomach stability in dynamic movements. 3. Ensure proper and normal placement of the joints in motion. In these exercises, resistance and exercise overload should be applied based on individual abilities. Ultimately, the final strategy of DNS exercises is "train the brain", which is created by the guidance of the practitioner with the aim of establishing central control, articulation stability and optimal movement quality. The central control system creates an automated model that will be part of everyday movements and skills by repeating the exercise (Frank *et al*., 2013). Finally, considering that posture stability does not only obtain through developing the muscle of the body and regardless of the coordination between the muscles in dynamic movements and also the regulation of intra-abdominal pressure. The study considered to study the effect of DNS exercises, which claims that can lead to new neurological pathways in the patients with brain stroke through brain exercises by calling the motor growth patterns of a healthy infant from birth to one year.

METHODOLOGY

This research was carried out using a semi-experimental method with applied and

targeted nature. The statistical society consisted of all patients with stroke referring to Mehr rehabilitation clinic in Karaj. The research sample included of 30 patients (15 males and 15 females) with ischemic stroke who referred to the clinic that had been approved by a physician for non-communicable disease. After selecting the samples based on the criteria for entering the research, they were randomly divided into two exercise and control groups with 15 and 15 persons, respectively. To enter the study, the samples had the same conditions, such as at least one year of stroke, a low to moderate disability, no relapse of the disease in the last 4 weeks, and persistence of vital signs in the patient. Samples that had to interfere with the use of a new drug during the course of the program, serious problems, recurrence of symptoms, and a history of exercise were not entered into the project or were excluded. After a complete descriptions and familiarization of the samples with regard to the purpose and manner of conducting the research, the subjects completed the consent form of the research project without any coercion and with their personal willingness. Sample demographic information was recorded through a data collection form. In the pretest phase, which was performed on a day apart from the first day of exercise, the quality of life questionnaire (SF-36) was used to assess the quality of life of the samples. The details and method of completing the Quality of Life Questionnaire (SF-36) were fully described for the samples. The dimensions measured in this questionnaire consist of eight sub-scales, which are as follows: Physical function, role disorder due to physical health, role impairment due to emotional health, energy / fatigue, emotional well-being, social function, pain and general health. Montazeri *et al*. (2005) showed that this questionnaire has a reliable and reliable validity (Montazeri *et al*., 2005). Berg Balance Scale (BBS) Test was used to measure the performance of the samples. The Berg Balance Scale (BBS) Test was consisted of 14 simple equilibrium tasks ranging from sitting to standing and standing on one leg. The 14 tasks were rising from the chair (step 1), standing without support (step 2), sitting in a seat without support (step 3), seating on the seat from standing position (step 4), transferring test for rotary displacement (step 5), static standing with closed eyes for 10 seconds (step 6), statistic standing with open eyes and pairing legs (step 7), forward access (step 8), removing objects from the ground (step 9), lateral rotation (step 10), rotation of a complete round (step 11), respective placing of one leg on the step or stair one by one (step 12), standing in a position with one leg on the other leg, standing on one leg (step 13) (Image 1).

Image 1: Berg Balance Scale (BBS) Test

The duration of the test lasted about 15 to 20 minutes. For each of the 14 steps, a score of between 0 and 4 was assigned, with zero score indicating complete disability (imbalance) and score 4 indicating independence. Finally, the obtained score was collected in all stages and the total assessment score was obtained. The Berg Balance Scale (BBS) Test has high intra-group and out-group reliability (Hadian *et al*., 2007), and has a good validity (Berg *et al*., 1992).

After performing the pre-test, the DNS exercise program was performed for eight weeks and three sessions per week, each session for 90 minutes each day for experimental group subjects. The exercises were supervised by a specialist in corrective actions. Each exercise was based on a neonatal pattern designed to gradually lift the center of gravity on the ground and rise up with maintaining stability (Image 2). The exercises were designed at three simple levels (first and second week), moderate (third and fourth week) and advanced (fifth to eighth). From the simple to the advanced level, the purpose of rotation to the abdomen and flanks was to lift the center of gravity into quadruple and legs, sit and eventually rise (Image 2).

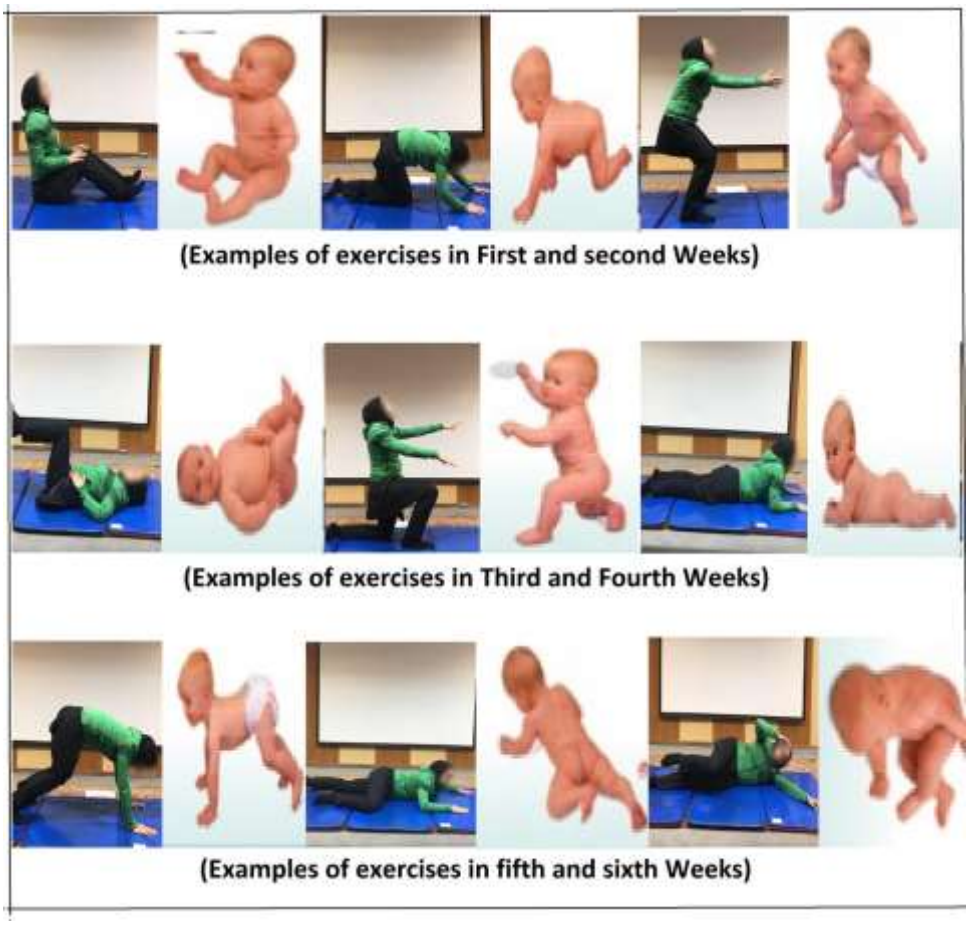

Image 2: A sample of DNS exercises

The control group continued their everyday activities without any exercise. After the desired time for the control group and the implementation of eight weeks of exercise for the experimental group, the subjects again were evaluated by Berg Balance Scale (BBS) Test and quality of life questionnaire. In this research, descriptive and inferential statistics were used to analyze the data. Normal assumption and naturalness of the data was analyzed using Kolmogorov-Smirnov test and parametric tests were used

regarding to the data normality. Independent t-test was used to examine the changes between groups and independent t-test was used to examine the changes within the group.

RESULTS

Describing the individual characteristics of the subjects including age, height, weight, and body mass index are presented in Table 1.

Table 1: Individual characteristics of the subjects divided based on the research groups (standard deviation ± mean)

Groups	Number of Samples	Age (year)	Height (Centimeter)	Weight (Kilogram)	Body mass index (Kg/m^2)
Experimental	15	60/80±10/73	159/24±5/89	65/94±8/32	25/45±10/73
Control	15	57/53±8/52	161/73±5/06	63/88±6/40	24/66±10/73

Intra-group comparison of quality of life dimensions of the samples in the two groups of control and exercise was obtained using the correlated t-test is presented in Table 2. In-group comparison of pre-test and post-test showed that there were no significant changes in the dimensions of quality of life of the samples in the variables of physical function, role impairment due to emotional health, social function and general health ($p>0/05$). But in other dimensions of quality of life, role disorder was significant due to physical health, energy, emotional well-being and pain at a 95% confidence interval ($p>-0/05$).

Table 2: Describe and compare intra-group sub-quality of life before and after the exercise course divided based on the group

Variable	Groups	standard deviation ± mean		In-group changes	
		Pre-test	Post-test	t amount	P value
Physical function	**Experimental**	49/34±17/12	53/66±25/52	1/27	0/083
	Control	46/76±15/94	46/07±16/73	0/56	0/274
Role Disorder Due to Physical Health	**Experimental**	18/18±5/29	34/35±12/14	11/73	*0/001
	Control	21/23±7/60	19/79±7/06	0/80	0/157
Disordered role due to emotional health	**Experimental**	47/13±18/66	49/18±18/20	1/13	0/102
	Control	51/90±17/31	48/13±16/74	1/02	0/111
Energy	**Experimental**	38/18±15/19	49/72±19/91	10/06	*0/002
	Control	35/67±15/25	34/24±13/70	0/73	0/228
Emotional well-being	**Experimental**	50/20±19/70	58/37±21/33	8/59	*0/003
	Control	47/46±20/71	49/70±18/14	0/94	0/109
Social function	**Experimental**	57/00±21/39	61/43±2067	1/84	0/072
	Control	55/70±1983	54/98±18/32	0/69	0/237
Pain	**Experimental**	40/55±14/24	51/72±1883	10/23	*0/002
	Control	42/18±14/52	41/13±15/07	0/77	0/217
General health	**Experimental**	40/25±11/28	43/87±14/13	1/25	0/089
	Control	43/90±13/73	44/61±16/49	0/91	0/116

* Sig level $p\geq0/05$

The results of in-group and inter-group comparisons of total quality of life and performance of the samples in the control and exercise groups are presented in Table 3.

In-group comparison of pre-test and post-test showed that the total score of functional tests and post-test quality of life in the exercise (experimental) group was significantly different from that of the pre-test ($p>-0/05$).

But in the control group, this change was not significant ($p>0/05$). Differences between groups of these variables were also significant and beneficial to the exercise group.

Table 3: Intra-and intra-group comparison between quality of life variables and performance

Variable	Comparison	Loon Test		Group	standard deviation ± mean		Freedom degree	t amount	P value
		F	P		Pre-test	Post-test			
Total score of functional tests (Berg Balance Scale (BBS) Test)	Intra group differences (correlated t)	-		Experimental	33/20±15/39	16/15 ±20/40	14	11/37	*0/001
		-		Control	30/19±13/46	29/84±15/16	14	0/86	0/189
	Intergroup differences (Independent t)	1/74	0/19	Experimental-Control	3/01±1/93	10/36±0/36	28	9/77	*0/002
Total quality of life score	Intra group differences (correlated t)	-		Experimental	42/60±17/25	50/28±21/19	14	10/15	*0/001
		-		Control	43/10±16/90	42/33±17/63	14	0/94	0/167
	Intergroup differences (Independent t)	0/71	0/79	Experimental-Control	-0/05±0/35	7/59±3/56	28	8/01	*0/003

* Sig level p≥0/05

DISCUSSION AND CONCLUSION

Stroke is the most important cause of long-term disability and disability in adults and the elderly. Common therapeutic interventions for addressing these problems after a stroke in occupational therapy are targeted physical exercises and activities. Sometimes the use of these interventions for patients is along with disadvantages and its usage is difficult or impossible and with a great cost. Therefore, the use of appropriate therapeutic approaches to improve balance and quality of life is necessary (Eghlidi *et al*., 2015). Therefore, a therapeutic protocol including functional, balance and strengthening exercises based on neurom-uscular stability for treatment of these disorders based on theoretical principles derived from the principles of control and learning of movement, status control and principles of muscle strength were developed and implemented in this study. The basis of the Therapeutic Approach (DNS) is the accurate assessment of the quality of the stability or movements aimed at storing the integrated system of spinal stability through specific functional exercises based on the growth kinematics positions exhibited by healthy infants. In this regard, according to the findings of Yoon and You (2017), these exercises should activate and protect the dynamic patterns in the open chain when moving to objects, throwing, kicking, moving forward (Yoon and You, 2017). Basically, any growth position is an exercise position, but each exercise should follow a series of principles that are: 1. Restore the appropriate respiratory pattern and adjust the intra-abdominal pressure; 2. Create high protection in dynamic movement in the limbs; and 3. Ensure the centrality of all joints in the head. The ultimate strategy is to train the mind to maintain central control, detailed stability and perfect movement quality that are obtained by the therapist's guidance. In examining the effect of these exercises on the performance and balance of patients with stroke, the results of this study showed that these exercises are effective in improving patients' function. This conclusion is also repeated in the findings of Kim *et al.* (2017), and Frank *et al*. (2013) (Frank *et al*., 1992; Kim *et al*., 2017). In fact, if (DNS) exercises done correctly, they can reduce motor stroke patients' problems. In total, it seems that improving the physical capabilities of the specimens by virtue of DNS exercises can improve the functioning of the motor system. So that more coordination between the musculoskeletal system and muscle recall at the right time and duration, improper movements and inappropriate motion control in these patients replace itself with the smarter and more accurate muscle system. This can reduce energy consumption and energy savings by

using less muscle and, of course, more effective in the human motor system (Frank *et al*., 1992). Examples of this study, with regular scheduling in the course of eight weeks of practice, have been removed from inertia, and having a regular exercise program of three days a week increases daily activity and muscle activity that eventually, the program has been instrumental in improving the patient's physical performance. On the other hand, DNS exercises, with the pattern of healthy motor growth, gradually lead the person from standing to the side and then standing up to control the whole body's stability. These exercises that move away from the gradual increase of the center of gravity can have a good effect on static control and static equilibrium.

Therefore, improvement in the balance and functional stability of these patients can be attributed to the shape and design of DNS exercises. In line with this result, although little research is consistent with it, the effect of exercise training on the physical health of patients with stroke has been shown in various studies. Findings of Kim *et al*. (2017), Yoon and You (2017), De Oliveira (2016), Saunders *et al*. (2016), and Azad *et al*. (2013) is coincide with these results (Yoon and You, 2017; Kim *et al*., 2017; De Oliveira and D' Oliveira, 2016; Saunders *et al*., 2016; Azad *et al*., 2014).

As noted, stroke is a clinical syndrome which is characterized by localized neurological defects and often classified as a chronic disabling disease. Stroke has a profound effect on the quality of life of patients and these effects are categorized by the World Health Organization under the headings of lesion, disability and inability. In recent years, several methods have been proposed to increase and improve the quality of life of patients and increase their rehabilitation (Torbey and Selm, 2013). The proposed method of this study was the implementation of eight weeks of dynamic neuromuscular stability exercises (DNS) to evaluate its effect on improving the movement and function of patients, and on the other hand, the impact of these exercises on quality of life and its indicators. The results showed that performing these exercises is effective in improving the quality of life of patients.

In contrast, Cao *et al*. (2007) concluded that the effect of 12 weeks of combined exercise training program on static equilibrium and quality of life in elderly subjects was not significant (Cao *et al*., 2007). The inconsistency of the findings of this research with some researches on some factors can be attributed to differences in methodology, including the type, nature, and intensity of training interventions. For example, Cao *et al*. intervention's intervention lacked the equilibrium component. However, the intervention of the present study, in addition to the equilibrium component, also had two parts of the initial elongation and the final elongation. The intervention program of the present study did not significantly affect the subscales of physical function, role impairment due to emotional health, social function and general health due to mental problems and social function. Barnett *et al* (2003) stated that after six months, group training did not affect the quality of life of the elderly over 65 years old (Barnett *et al*., 2003). Also, in Rubenstein *et al* (2000), a group exercise program did not have a significant effect on the perceived physical function subscale (Rubenstein *et al*., 2000). Chen *et al* (2008) also did not find the effect of a simplified Tai Chi program on the physical health index (Chen *et al*., 2008). Reinsch *et al* (1992) found that perceived health did not change significantly after a 12-month intervention program (Reinsch *et al*., 1992). The quality of life of these patients was not disturbed, so that the average of most indicators of quality of life was less than 50 in these patients. It has been shown that stroke is the most debilitating disease in the elderly, which greatly affects their quality of life. In this context, Pinedo *et al* (2017), Chan *et al*. (2017), Katona *et al* (2015), Opara and Jaracz (2010), Jafari and Dalvandi (2014), Fatahi *et al* (2008) also confirmed the poor quality of life of stroke patients in their findings (Opara and Jaracz,

2010; Pinedo *et al*., 2017; Chan *et al*., 2017; Katona *et al*., 2015; Jafari and Dalvandi, 2014; Attar Sayyah *et al*., 2016). But according to the results of this study, the quality of life and its indicators have improved somewhat in these patients by improving exercise and dynamic neuromuscular stability exercises. One of the possible reasons for improving the quality of life of these patients in this study is the improved functional and postural control of these patients. In the previous section, the balance performance of these patients was significantly improved after eight weeks of DNS training. Improving motor function in patients can provide the basis for motor autonomy of these individuals, especially in everyday life, and provide them with greater freedom of movement and act. This can create a better sense of health for individuals. Therefore, it was observed that there was a significant improvement in role disorder index due to physical health. In this regard, Bergstrom *et al* (2015) have identified sport and exercise activities as one of the factors influencing the quality of life of stroke patients, which is consistent with the results of this study (Bergström *et al*., 2015).

According to the quality of life indicators, the results of this study showed that the implementation of eight weeks' dynamic neuromuscular stability (DNS) exercises is effective on improving mental health and physical health of patients. The first indicator of physical health is role impairment due to physical health, which, according to the results of this study, is effective in improving this disorder. Physical health and problems caused by physical inactivity, including those that these patients involved themselves with them. These problems affect many of the daily activities and social activities, that in result, these patients no longer being able to play their social roles in life and in society. Exercise interventions and neurological stability exercises have somewhat reduced these problems in these patients, which is worth paying attention to.

Also, energy that is a component of mental health has improved in these individuals and the rate of fatigue caused by disability has been reduced. In fact, fatigue has improved after eight weeks of training. This conclusion is consistent with the findings of Attar *et al* (2015), which is based on the reduction of fatigue and increased energy (Attar Sayyah *et al*., 2016). In this context, the Pathointensial topics suggest that in functional disorder, the muscles generally call to create motion sooner or later of the appropriate time for movement. On the other hand, sometimes motor disorder is required with insufficient or excessive muscular strength. Finally, such events that have been raised as muscle imbalances make muscles inappropriate and ineffective. As a result, a person suffering from motor disorder does his acts with high energy consumption and low efficiency. Failure to comply with the principle of energy savings in the motor system will ultimately result in poor quality and unskilled execution with high and early fatigue (Frank *et al*., 2013). The result of this study showed that DNS exercises may have normalized neuromuscular control and ultimately control the functioning of the musculoskeletal system at the desired level. The result of this event has been to reduce muscle energy consumption and increase the efficiency of the motor system and ultimately reduce the level of general body tiredness.

The emotional well-being of other components of mental health has also increased as a result of these exercises, which can be due to improved emotions such as reducing stress and depression and positive self-awareness due to improved motor function. With improving motor performance, individual satisfaction and sense of independence may have created positive emotions in people. Eventually, muscle pain caused by stroke in these individuals was reduced by these exercises. Pain is a component of mental health which the reason for its probable reduction in these patients is to improve motor function, improve balance, reduce general fatigue and

reduce articular pressure due to muscle imbalance which at the final point reduces pain by improving the accuracy of joint movements and reducing the stressor in the joint. On the other hand, improving the emotional characteristics of patients can also be the basis for pain relief. This is consistent with the findings of Kobesova *et al* (2017) and Davidek *et al* (2017) (Kobesova *et al*., 2015; Davidek *et al*., 2017). But in other indicators of quality of life, namely, physical functioning, role impairment due to emotional health, social function and general health, according to the results of this study, these exercises did not affect the improvement of these indices and there was no improvement in these variables. One of the possible reasons for this is that the exercises performed in these variables have not been able to reduce stress caused by patients' imbalance and irritability of the joints and other physical limitations have impacted their participation in these training programs.

In general, it should be said that the quality of life is a broad concept that measures lesion, disability, and disability at the same time. There is now a general agreement on the quality of life of stroke patients, which is that the disease is highly effective in patients' quality of life. This disease disables humans. In fact, one of the complications of stroke is paralysis and motor disability. Therefore, for the treatment, care and return of the patient to his or her previous physical, psychological and social status, efforts should be made. One of the effective ways to achieve this goal is rehab. The goals of exercise exercises and corrective actions are to help the client to achieve maximum independence and to conduct the daily routine of life. Rehabilitation programs serve as an important therapeutic goal for patients to be independent and avoid hospitalization and reduce the costly costs. Therefore, with the emphasis on the remaining abilities, they should be as strong as possible to empower them and to help them to self-help them to take care of themselves. Accordingly, one of the methods of rehabilitation, which is the same as the use of dynamic neuromuscular stability based exercises and confirmed by this research, is suggested in these patients. The results of this study showed that neuromuscular exercises have a positive effect on improving the performance and quality of life of stroke patients during the 8-week training period, so the effect of exercise training on improving the balance and quality of life of these patients has been confirmed. Accordingly, this study suggests a practice protocol for functional, balance and strengthening exercises based on neuromuscular stability to treat these disorders. Also, exercise training is suggested as an adjunct therapy, along with therapeutic treatments for patients with stroke. The results of this research support the improvement of quality of life and performance of samples by performing DNS exercises. Therefore, this practice is recommended as a suitable sport for patients with mild to moderate stroke. Ultimately, stroke is one of the diseases that people need to choose an active lifestyle to improve their condition and prevent recurrence. Therefore, it is recommended that these patients continue their exercise exercises in a lifelong way.

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