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Physiotherapy and Dynamic Exercises as Interventions for Improving the Functional Efficiency of the Frozen Shoulder in Elderly People with Type 2 Diabetes.

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Abstract

The current research aims at designing a recommended program to increase the functional efficiency of the frozen shoulder in elderly male patients with type 2 diabetes and identifying its effects on improving the muscular strength of shoulder muscles on all directions, the range of motion of the frozen shoulder on flexion, extension and adduction movements, the degree of pain and the blood sugar. The researchers used the quasi-experimental approach (one-group design) with pre-, intermediate and post-measurements. Subjects (n=8) were purposefully chosen from elderly males (50-60 years) with frozen shoulder and type 2 diabetes who undergo treatment at Kafr Al-Shaikh Sports Club rehabilitation clinic. The researchers concluded that using physiotherapy with dynamic rehabilitation exercises increased the muscle strength of the working muscles of the shoulder joint in cases of patients of frozen shoulder with type 2 diabetes. Using physiotherapy with dynamic rehabilitation exercises range of motion of the shoulder joint in cases of patients of frozen shoulder with type 2 diabetes The recommended program led to significant improvements for pain and blood sugarThere are statistically significant differences on all the research variables in favor of the post-measurements. These improvements are due to the use of physiotherapy (thermal treatment) with rehabilitation exercises in cases of elderly people with frozen shoulder and type 2 diabetes.

Introduction:

Shoulder joint is one of the most important anatomical and structural constructs of the human body. It is a very complex multi-façade joint and multi-usage joint with a great range of motion as it is the only joint in the human body with a rotation range of full 360 degrees. Therefore, it is more flexible than any other joint. This type of joints is called "ball and socket". This particular joint consists of a joint surface with the humeral head attached with the trapezoid hole at the lateral angle of the shoulder.

An articular capsule surrounds the shoulder from outside for protection. The shoulder joint is very flexible but its flexibility cannot be maintained unless its complex function is working regularly. Therefore, if any part of the joint is injured, its movement decreases and pain begins to appear.

The shoulder griddle consists of a group of joints that work synchronously. Its complex structure, in addition to various ranges of motion for its parts makes this griddle more vulnerable to injuries, compared to other joints of the body. Rehabilitation of the shoulder joint is very important to maintain flexibility and restore regular functionality of the upper limp. (27:131)

Experts agree that there are three major ligaments that stabilize the shoulder joint and protect it. These are the concoid ligament, the trapezoid ligament and the coracoacromial ligament (25:76) (14:14) (11:127) (19:21-22)

Elrekhawy (199)) indicated that blood supplement of this joint comes through the axillary artery and the brachial artery. At its end, the brachial artery is divided into the radial and the ulnar arteries that provide muscles and skin with blood supply. In addition, he also indicated that the innervations of the shoulder joint come from the axillary nerve, the supraspinatus nerve and the lateral thoracic nerve (20: 132:136:137)

Through review of literature and field experience of researchers in rehabilitating such injuries, the researchers concluded that the most important muscles responsible for the frozen shoulder are: anterior deltoid, medial deltoid, posterior deltoid, latissimus dorsi, infraspinatus, pectoralis major, trapezoid medial, Terries major, triceps and biceps (15:144-155) (23:335-241) (28:89)

Frozen shoulder (adhesive Copsufitis) is a painful restrain of motion of the shoulder due to injury of the shoulder joint itself without injuries at the soft tissues. Prevalence rate of this injury is between 2-5% of population, with 60% of injuries in females. Recent studies indicated that diabetic patients are five times more vulnerable to the frozen shoulder, compared to others, at the age 40-60 years.

Normally, injury happens at the frontal part of the shoulder as pain increases suddenly and quickly when fast moves of the injured arm are initiated. Pain may last from a few minutes to longer periods of time until the injured patient is no longer able to move the injured shoulder in addition to being unable to perform any vital functions that may need mobility of the shoulder. The frozen shoulder goes through three consecutive phases:

- Phase one (1-8 months): where pain and freezing are very intense
- Phase two (9-16 months): where immobility increases significantly
- Phase three (12-40 months): this is the de-freezing phase where the paint begins to feel more comfortable

Major physiological causes of the frozen shoulder include the inflammation of shoulder capsule that leads to restraining the joint's movement and freezing it. This means that the shoulder loses its normal range of motion in all directions and muscles become weak (18: 150-153) (22: 645-651).

Shoulder joint is more vulnerable to injuries due to its vast range of motion and excessive movement loads over it. This particular joint depends on a major muscle (Deltoid Major) supported by smaller group of muscles (Cuff Rotators) as these muscles play an important role in the joint stability and muscular work (21: 223) (24:53).

Quoting David Lp and Haiat Aiiad (2003), Ahmed Saleh (2010) indicated that rehabilitation is an educational process and a solution to the problem that aim at decreasing the poor physical conditions accompanying the injury. Rehabilitation is a major aspect of treating many sorts of injuries as it works on eliminating the functional disorder of the injured part through strengthening muscles, ligaments and joints. Exercises work on improving and developing muscular strength, joint flexibility and muscular nervous coordination so that the patient restores his/her normal condition to the maximum possible level (1:4) (3:172)

Stasinopoulos (2007) indicated that early movement of the injured part maintains the joint health and if the patient was unable to move due to pain, passive movement of the joint may help healing the injury as it works on maintaining the joint's mobility and increasing the joint's ability to feed itself and therefore improves its functionality (28:39)

Quoting Mc. Mahon & Patrick J. (2007) Ahmed Saleh (2010) indicated that rehabilitation exercises can be classified into static and dynamic exercises where dynamic exercises include active exercises for starching and increasing the range of motion to maintain mobility. Dynamic exercises are used after static exercises (1: 7)

Rehabilitative moves include passive movements, supported movements, active movements, and stretching, resistance and coordination movements.

Ali Galal El-Din (2005) indicated that physiotherapy equipments work on activating blood circulation and lymphatic circulation, in addition to providing tissues with nutrition, increasing elasticity of muscles, ligaments and tendons and improving the functional efficiency and metabolic capacity of the body (8:163)

Accordingly, the researcher suggested the use of physiotherapy methods (thermal treatment) accompanied with dynamic exercises to increase the functional efficiency of the frozen shoulder in elderly male patients with type 2 diabetes.

Aims:

The current research aims at designing a recommended program to increase the functional efficiency of the frozen shoulder in elderly male patients with type 2 diabetes and identifying its effects on:

1. Improving the muscular strength of shoulder muscles on all directions
2. Improving the range of motion of the frozen shoulder on flexion, extension and adduction movements
3. Improving the degree of pain
4. Improving the blood sugar

Hypotheses:

There are statistically significant differences between the pre- and post- measurements, in favor of the post-measurements on:

a) The muscular strength of shoulder muscles on all directions

b) The range of motion of the frozen shoulder on flexion, extension and adduction movements

c) The degree of pain

d) The blood sugar

Methods:

Approach:

The researchers used the quasi-experimental approach (one-group design) with pre-, intermediate and post-measurements.

Subjects:

Subjects (n=8) were purposefully chosen from elderly males (50-60 years) with frozen shoulder and type 2 diabetes who undergo treatment at Kafr Al-Shaikh Sports Club rehabilitation clinic.

Equipments:

Equipments include a restameter for measuring heights, a medical balance for measuring weights, infra-red device,

ultra-sonic device, paraffin wax path, muscular strength electronic meter, digital goniometer for measuring the range of motion, sand bags with various weights, bold sugar measurement device, rotator wheel of the shoulder, VAS scale for the degree of pain and data collection forms.

The recommended program:

The program includes physiotherapy methods (thermal treatment) like infra-red, ultra-sonic and paraffin wax. In addition, other motor equipments were used like sand bags with various weights and rotator wheel of the shoulder with dynamic exercises for improving the muscular strength of the shoulder muscles and stretching for improving the range of motion of the frozen shoulder. The program was initiated for (12) weeks (3 units per week) with duration of (35-55) minutes for every unit. The program was divided into two parts (6 weeks each).

The first part of the program aimed at decreasing inflammation and pain and preventing the muscle weakness and atrophy to maintain the muscular tune and its functional ability, in addition to gradual strengthening of the working muscles. The second part aimed at improving muscular strength and range of motion and decreasing pain and bold sugar to restore the normal functionality of the frozen shoulder as possible.

Each unit was divided into two parts:

Warm-up (15-25 minutes) using thermal treatment (infrared, ultrasonic and paraffin wax)

Main (rehabilitation) part (20-30 minutes) using dynamic exercises with sand bags with various weights and rotator wheel of the shoulder to improve the functional efficiency of working muscles and increasing the range of motion of the frozen shoulder in addition to decreasing the degree of pain.

Main application lasted for (12) weeks (from 2-8-2012 to 26-10-2012). This began with pre-measurements followed by 6 weeks of intervention then an intermediated measurement. Post-measurements were taken after 6 weeks of the program after the intermediate measurements.

Results:

Table (1)
Description of sample members on main variables for data normality (n=8)

Variable	Measurement	Mean	Median	SD	Kurtosis	Skewness
Growth Factors						
Age	**Year**	**54**	**52.50**	**3.46**	**-7.73**	**0.50**
Height	**Cm**	**174**	**173**	**3.74**	**-0.87**	**0.44**
Weight	**Kg**	**95.13**	**98**	**7.41**	**-0.38**	**-0.92**
Strength of muscles working on shoulder joint						
1st muscle	**Kg**	**10.48**	**9.95**	**1.62**	**-0.29**	**1.04**
2nd muscle	**Kg**	**10.15**	**10.05**	**1.74**	**2.06**	**0.52**
3rd muscle	**Kg**	**10.04**	**9.90**	**0.93**	**1.38**	**2.12**
4th muscle	**Kg**	**10.29**	**10.20**	**0.60**	**-0.60**	**0.25**
5th muscle	**Kg**	**5.99**	**6.10**	**0.44**	**0.00**	**-0.62**
6th muscle	**Kg**	**8.39**	**8.20**	**1.05**	**1.05**	**2.09**
7th muscle	**Kg**	**11.08**	**10.95**	**1.10**	**-0.23**	**0.52**
8th muscle	**Kg**	**11.45**	**11.10**	**1.75**	**3.60**	**1.73**
9th muscle	**Kg**	**9.13**	**8.90**	**0.77**	**-1.02**	**0.73**
10th muscle	**Kg**	**12.56**	**12.75**	**1.48**	**1.72**	**2.23**
Range of motion						
Flexion	**Degree**	**81.25**	**83.50**	**9.19**	**-0.29**	**-0.25**
Extension	**Degree**	**20.75**	**20.00**	**2.82**	**-0.66**	**0.90**
Adduction	**Degree**	**44.13**	**42.00**	**4.49**	**-0.68**	**1.06**
Degree of pain	**Point**	**7.38**	**7.50**	**1.06**	**-0.94**	**-0.05**
Sugar in blood	**Point**	**196.88**	**200.00**	**13.35**	**-1.97**	**-0.36**

Table (1) indicates that Skewness values ranged between (3±). This indicates that data are normal and free of abnormal distributions.

Table (2)
Variance analysis among the three measurements
(pre-, intermediate and post-) on strength of muscles working on the shoulder joint

Variable	Variance Source	Degree of Freedom	Sum of Squares	Means of Squares	F
1st muscle	Intra-measurements	2	14.183	7.091	4.660
	Inter-measurements	21	31.954	1.522	
	Total	23	46.136		
2nd muscle	Intra-measurements	2	9.303	4.652	3.733
	Inter-measurements	21	26.170	1.246	
	Total	23	35.473		
3rd muscle	Intra-measurements	2	20.756	10.378	3.518
	Inter-measurements	21	61.950	2.950	
	Total	23	82.706		
4th muscle	Intra-measurements	2	18.503	9.252	10.713
	Inter-measurements	21	18.136	0.864	
	Total	23	36.640		
5th muscle	Intra-measurements	2	6.257	3.129	4.231
	Inter-measurements	21	15.528	0.739	
	Total	23	21.785		
6th muscle	Intra-measurements	2	29.666	14.833	6.234
	Inter-measurements	21	49.964	2.379	
	Total	23	79.630		
7th muscle	Intra-measurements	2	13.911	6.955	4.647
	Inter-measurements	21	31.429	1.497	
	Total	23	45.340		
8th muscle	Intra-measurements	2	15.584	7.792	3.547
	Inter-measurements	21	46.137	2.197	
	Total	23	61.721		
9th muscle	Intra-measurements	2	13.001	6.500	8.543
	Inter-measurements	21	15.979	0.761	
	Total	23	28.980		
10th muscle	Intra-measurements	2	18.301	9.750	6.988
	Inter-measurements	21	27.498	1.309	
	Total	23	45.798		

F table values on degrees of freedom (2, 21) and $p \leq 0.005 = 3.47$

Table (2) indicates statistically significant differences among the three measurements. This led the researchers to perform LSD test to show the least significant differences.

Table (3)
LSD among the three measurements
(pre-, intermediate and post-) on strength of muscles working on the shoulder joint

Variable	Measurement	Mean	Means differences			LSD
			Pre-	Intermediate	Post-	
1st muscle	Pre-	10.48		0.78	1.87* ↑	1.27
	Intermediate	11.26			1.09	
	Post-	12.35				
2nd muscle	Pre-	10.15		0.76	0.53*↑	1.15
	Intermediate	10.93			0.77	
	Post-	11.68				
3rd muscle	Pre-	10.04		1.24	2.27*↑	1.92
	Intermediate	11.28			1.03	
	Post-	12.31				
4th muscle	Pre-	10.29		1.02*↑	2.15*↑	0.97
	Intermediate	11.31			1.13*↑	
	Post-	12.44				
5th muscle	Pre-	5.99		0.66	1.25*↑	0.89
	Intermediate	6.65			0.59	
	Post-	7.24				
6th muscle	Pre-	8.39		0.96	2.69*↑	1.60
	Intermediate	9.35			1.73*↑	
	Post-	11.08				
7th muscle	Pre-	11.08		0.85	1.86*↑	1.27
	Intermediate	11.93			1.01	
	Post-	12.94				
8th muscle	Pre-	11.45		0.68	1.75*↑	1.52
	Intermediate	12.13			1.07	
	Post-	13.20				
9th muscle	Pre-	9.13		0.98*↑	1.79*↑	0.90
	Intermediate	10.11			0.81	
	Post-	10.92				
10th muscle	Pre-	12.56		1.00	2.14*↑	1.19
	Intermediate	13.56			1.14	
	Post-	14.70				

Table (3) shows the least significant differences among the three measurements.

Table (4)
Improvement percentages among the three measurements
(pre-, intermediate and post-) on strength of muscles working on the shoulder joint

Variable	Measurement	Mean	Means differences		
			Pre-	Intermediate	Post-
1st muscle	Pre-	10.48		7.44	17.84
	Intermediate	11.26			9.68
	Post-	12.35			
2nd muscle	Pre-	10.15		7.49	15.07
	Intermediate	10.93			7.06
	Post-	11.68			
3rd muscle	Pre-	10.04		12.35	22.61
	Intermediate	11.28			9.13
	Post-	12.31			
4th muscle	Pre-	10.29		9.91	20.89
	Intermediate	11.31			9.99
	Post-	12.44			
5th muscle	Pre-	5.99		11.02	20.87
	Intermediate	6.65			8.87
	Post-	7.24			
6th muscle	Pre-	8.39		11.44	32.06
	Intermediate	9.35			18.50
	Post-	11.08			
7th muscle	Pre-	11.08		7.67	16.79
	Intermediate	11.93			8.47
	Post-	12.94			
8th muscle	Pre-	11.45		5.94	15.28
	Intermediate	12.13			8.82
	Post-	13.20			
9th muscle	Pre-	9.13		10.73	19.61
	Intermediate	10.11			8.01
	Post-	10.92			
10th muscle	Pre-	12.56		7.96	17.04
	Intermediate	13.56			8.41
	Post-	14.70			

Table (4) shows the improvement percentages among the three measurements of the strength of muscles working on the shoulder joint.

Table (5)
Variance analysis among the three measurements (pre-, intermediate and post-) on the range of motion

Variable	Variance Source	Degree of Freedom	Sum of Squares	Means of Squares	F
Flexion	Intra-measurements	2	4114.750	2057.375	25.372
	Inter-measurements	21	1702.875	81.089	
	Total	23	5817.625		
Extension	Intra-measurements	2	564.583	282.292	27.799
	Inter-measurements	21	213.250	10.155	
	Total	23	777.833		
Adduction	Intra-measurements	2	1090.3333	545.167	24.908
	Inter-measurements	21	459.625	21.887	
	Total	23	1549.958		

F table values on degrees of freedom (2, 21) and p≤0.005 = 3.47

Table (5) indicates statistically significant differences among the three measurements. This led the researchers to perform LSD test to show the least significant differences.

Table (6)
LSD among the three measurements (pre-, intermediate and post-) on the range of motion

Variable	Measurement	Mean	Means differences			LSD
			Pre-	Intermediate	Post-	
Flexion	Pre-	81.25		14.13*↑	32.00*↑	9.28
	Intermediate	95.38			17.87*↑	
	Post-	113.25				
Extension	Pre-	20.75		5.63*↑	11.88*↑	3.28
	Intermediate	26.38			6.25*↑	
	Post-	32.63				
Adduction	Pre-	44.13		8.75*↑	16.50*↑	4.82
	Intermediate	52.88			7.75*↑	
	Post-	60.63				

Table (6) shows the least significant differences among the three measurements on the range of motion.

Table (7)
Improvement percentages among the three measurements (pre-, intermediate and post-) on the range of motion

Variable	Measurement	Mean	Means differences		
			Pre-	Intermediate	Post-
Flexion	Pre-	81.25		17.39	39.38
	Intermediate	95.38			18.74
	Post-	113.25			
Extension	Pre-	20.75		27.13	57.25
	Intermediate	26.38			23.69
	Post-	32.63			
Adduction	Pre-	44.13		19.83	37.39
	Intermediate	52.88			14.66
	Post-	60.63			

Table (7) shows the improvement differences among the three measurements on the range of motion.

Table (8)
Variance analysis among the three measurements(pre-, intermediate and post-) on pain degree

Variable	Variance Source	Degree of Freedom	Sum of Squares	Means of Squares	F
Pain	Intra-measurements	2	46.083	23.42	17.43
	Inter-measurements	21	27.750	1.321	
	Total	23	73.833		

F table values on degrees of freedom (2, 21) and p≤0.005 = 3.47

Table (8) indicates statistically significant differences among the three measurements. This led the researchers to perform LSD test to show the least significant differences.

Table (9)
LSD among the three measurements (pre-, intermediate and post-) on pain degree

Variable	Measurement	Mean	Means differences			LSD
			Pre-	Intermediate	Post-	
Pain	Pre-	7.37		1.99*↑	3.37*↑	1.18
	Intermediate	5.38			1.38*↑	
	Post-	4.00				

Table (9) shows the least significant differences among the three measurements on pain degree.

Table (10)
Improvement percentages among the three measurements (pre-, intermediate and post-) on pain degree

Variable	Measurement	Mean	Means differences		
			Pre-	Intermediate	Post-
Pain	Pre-	7.37		27.00	45.73
	Intermediate	5.38			25.65
	Post-	4.00			

Table (10) shows the improvement differences among the three measurements on pain degree.

Table (11)
Variance analysis among the three measurements (pre-, intermediate and post-) on blood sugar

Variable	Variance Source	Degree of Freedom	Sum of Squares	Means of Squares	F
Blood sugar	Intra-measurements	2	1433.250	716.625	7.42
	Inter-measurements	21	2027.250	96.536	
	Total	23	3460.500		

F table values on degrees of freedom (2, 21) and p≤0.005 = 3.47

Table (11) indicates statistically significant differences among the three measurements. This led the researchers to perform LSD test to show the least significant differences.

Table (12)
LSD among the three measurements (pre-, intermediate and post-) on blood sugar

Variable	Measurement	Mean	Means differences			LSD
			Pre-	Intermediate	Post-	
Blood sugar	Pre-	196.88		11.63*↑	18.75*↑	10.12
	Intermediate	185.25			7.12	
	Post-	178.13				

Table (12) shows the least significant differences among the three measurements on pain degree.

Table (13)
Improvement percentages among the three measurements (pre-, intermediate and post-) on blood sugar

Variable	Measurement	Mean	Means differences		
			Pre-	Intermediate	Post-
Blood sugar	Pre-	196.88		5.91	9.52
	Intermediate	185.25			3.84
	Post-	178.13			

Table (13) shows the improvement differences among the three measurements on pain degree.

Discussion:

Table (3) indicates statistically significant differences between the pre- and post-measurements for all working muscles on the shoulder joint as difference values were 1.87, 1.53, 2.27, 2.15, 1.25, 2.69, 1.86, 1.75, 1.79 and 2.14 and these values were all over LSD values. Table (4) indicated that the improvement percentages ranged between 32.06% as the highest value for the 6th muscle and 15.07% as the lowest value for the 2nd muscle. The researchers think that using physiotherapy with dynamic rehabilitation exercises had positive effects on the strength of working muscles over the frozen shoulder. This is consistent with Van Den Ende (1998) who indicated that using a rehabilitation program for 6 weeks (2 units per week) on patient with frozen shoulder had positive effects on improving the muscular strength of the injured joint and, in turn, the functional efficiency of the joint (30:37). This is also consistent with Ezzat Mahmoud (1999) and Peterson et al (2007) who indicated the importance of exercises in improving the muscular strength of the injured joints as the rehabilitation program should include recommended exercises for improving muscular strength of the shoulder joint (7:63) (26:128). Marwan Al-Morsy (2009) and Fahd Al-Rashidy (2009) indicated that such programs had positive effects on improving the muscular strength of the working muscles around the shoulder joint and this leads to improving the functional and motor efficiency (12) (9).

Table (5) indicates statistically significant differences between the pre- and post-measurements for the range of motion as (F) values were 25.37, 27.80 and 24.91 for flexion, extension and adduction successively. These values were higher than (F) table value on freedom degrees of 2 & 21 on $p \leq 0.05$.

Tables (6 & 7) indicate statistically significant differences between the pre- and post-measurements for the range of motion for flexion in favor of the post-measurements as (F) value for the post-measurement was 32 while LSD value was 9.28. The improvement percentage between pre- and intermediate measurements was 17.39%. The improvement percentage between the intermediate and post-measurements was 18.74%. The improvement percentage between pre- and post-measurements was 39.38%. Tables (6 & 7) also indicate statistically significant differences between the pre- and post-measurements for the range of motion for extension in favor of the post-measurements as (F) value for the post-measurement was 11.88 while LSD value was 3.28. The improvement percentage between pre- and intermediate measurements was 27.13%. The improvement percentage between the intermediate and post-measurements was 23.69%. The improvement percentage between pre- and post-measurements was 57.25%. Tables (6 & 7) indicate statistically significant differences between the pre- and post-measurements for the range of motion for adduction in favor of the post-measurements as (F) value for the post-measurement was 16.5 while LSD value was 4.82. The improvement percentage between pre- and intermediate measurements was 19.83%. The improvement percentage between the intermediate and post-measurements was 14.66%. The improvement percentage between pre- and post-measurements was 37.39%. The researchers think that these improvements are due to the positive effects of the rehabilitation methods used on improving the range of motion for the injured joint. This is consistent with Brukner et al (2007) who indicated that it is very important that the range of motion of the injured joint should be equivalent with the range of motion of the healthy joint as there is a positive relationship between active range of motion and the muscular strength of the muscles performing these movements (16:28).

The recommended program included various exercises aiming at improving the muscular strength necessary for moving the joint and increasing its range of motion. Mohamed Shehata & Ahmed Al-Shazly (2006) indicated that most joints of good condition can perform movements over the full range of motion as they can move from full flexion to full extension as this distance is called the full range of motion (10:49).

This is consistent with Ayman Ali (2011), Said Abdullah (2010) & Mostafa Kolkila (2010) in that rehabilitation programs had positive effects on restoring the full range of motion for the injured joint (2) (5) (13)

Table (8) indicates statistically significant differences between the pre- and post-measurements for the degree of pain as (F) value was 17.43. This value was higher than (F) table value on freedom degrees of 2 & 21 on $p \leq 0.05$.

Tables (9 & 10) indicate statistically significant differences between the pre- and post-measurements for the degree of pain in favor of the post-measurements as (F) values between the pre- and intermediate measurements, the intermediate and the post-measurement and the pre- and post-measurements were 1.99, 1.38 and 3.37 successively

while LSD value was 1.18. The improvement percentage between pre- and intermediate measurements was 27%. The improvement percentage between the intermediate and post-measurements was 25.65%. The improvement percentage between pre- and post-measurements was 45.73%.

The researchers think that this improvement is due to the use of the recommended program. This is consistent with Reda Abd El-Rahman (2009) and Wael Omar (2008) who indicated that rehabilitation program lead to increasing the static and dynamic strength of the shoulder joint muscles in addition to increasing the range of motion of the same joint. Using ultrasonic and electric stimulation with rehabilitation programs decrease pain significantly (4) (15)

Table (11) indicates statistically significant differences between the pre- and post-measurements for the blood sugar as (F) value was 7.42. This value was higher than (F) table value on freedom degrees of 2 & 21 on $p \leq 0.05$.

Tables (12 & 13) indicate statistically significant differences between the pre- and post-measurements for the blood sugar in favor of the post-measurements as (F) values between the pre- and intermediate measurements, the intermediate and the post-measurement and the pre- and post-measurements were 11.63, 7.12 and 18.75 successively while LSD value was 10.12. The improvement percentage between pre- and intermediate measurements was 5.91%. The improvement percentage between the intermediate and post-measurements was 3.84%. The improvement percentage between pre- and post-measurements was 9.52%. This indicates the positive effect of the recommended program for treating frozen shoulder in decreasing blood sugar.

This is consistent with Samia Khalil (2011) in that physical and motor activities are very useful especially for type 2 diabetic patients (insulin dependants). As motor and physical activities decrease calories and this decreases the need for insulin. Physical activities can be performed with monitoring the sugar levels in blood as physical activities increase the tissues' sensitivity to insulin. (6)

Conclusions:

The researchers concluded that:

1. Using physiotherapy with dynamic rehabilitation exercises increased the muscle strength of the working muscles of the shoulder joint in cases of patients of frozen shoulder with type 2 diabetes.
2. Using physiotherapy with dynamic rehabilitation exercises range of motion of the shoulder joint in cases of patients of frozen shoulder with type 2 diabetes
3. The recommended program led to significant improvements for pain and blood sugar
4. There are statistically significant differences on all the research variables in favor of the post-measurements. These improvements are due to the use of physiotherapy (thermal treatment) with rehabilitation exercises in cases of elderly people with frozen shoulder and type 2 diabetes.

Recommendations:

The researchers recommend the following:

1. Using the recommended rehabilitation program with physiotherapy and dynamic exercises in cases of frozen shoulder in elderly people with type 2 diabetes
2. Improving the muscular strength of the shoulder griddle in addition to improving the range of motion for the shoulder joint
3. Improving flexibility of the frozen shoulder to improve its range of motion
4. Using the recommended rehabilitation program with physiotherapy and dynamic exercises for improving the degree of pain and blood sugar in elderly people with frozen shoulder and type 2 diabetes
5. Using the recommended rehabilitation program with physiotherapy and dynamic exercises in rehabilitation centers for the frozen shoulder

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