



**Research Article**

## **EFFECT OF CONTRAST BATH ON GRIP STRENGTH IN TYPE II DIABETES**

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Type II diabetes  
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Contrast Bath  
Grip Strength

### **ABSTRACT**

**Aim:** to study the effect of contrast bath on grip strength in type II diabetes

**Background:** DM is a metabolic disorder characterised by high blood glucose level in context of insulin resistance and relative insulin deficiency. Studies on type II diabetes has shown sarcopenia i.e. Loss of muscle mass with age. DM is associated with several musculoskeletal disorder. The pathological hallmark of diabetes mellitus includes the vasculature leading to both micro-vascular and macro-vascular complications which start appearing approximately after 5 years of onset of diabetes. It has been established that type 2 diabetes is a risk for functional disability and mobility limitation. Presence of cheiroarthropathy, frozen shoulder, dupuytren's contracture, trigger finger was observed in diabetic patient. Functional loss starts in a very early stage of type 2 diabetes mellitus and in later stage diabetic polyneuropathy might accelerate reduction in muscle strength. Small muscle wasting of hand in diabetes is bilaterally symmetrical and involves the of thenar and hypothenar Atrophy is most noticeable in first dorsal interossei with loss of normal rounded appearance. Posture of the thumb is altered with increasing muscle weakness.

**Objective:** To check the grip strength before applying contrast bath in type II Diabetic patients

To assess the grip strength following contrast bath in type II Diabetic patients

**Methodology:** An experimental study for a duration of 1 year conducted in a metropolitan city on diabetes population with a sample size of 50.grip strength assessment was done with a help of jamar dynamometer.

**Results:** significant difference was seen in grip strength followed by contrast bath.

**Conclusion:** This study concluded that contrast bath is effective for improving the grip strength in type II diabetes.

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## **INTRODUCTION**

DM is a metabolic disorder characterised by high blood glucose level in context of insulin resistance and relative insulin deficiency. Skeletal muscles maintain our posture and produces body movement. It has major role in glucose regulation, muscle being the site for glucose disposal.<sup>1</sup> Studies on type II diabetes has shown sarcopenia<sup>2</sup> i.e. Loss of muscle mass with age. Moreover there are various studies which show grip strength is reduced in diabetic patients Hyperglycaemia persistently lowers the muscle strength.<sup>3</sup>

DM is associated with several musculoskeletal disorder<sup>4,6,7</sup>. The pathological hallmark of diabetes mellitus includes the vasculature leading to both micro-vascular and macro-vascular complications which start appearing approximately after 5 years of onset of diabetes. It has been established that type 2 diabetes is a risk for functional disability and mobility limitation Connective tissue disorder, neuropathy, vascular disorder or combination of these problems may underline the increase risk of musculoskeletal disorders<sup>5</sup>. Most of these

disorders can be diagnosed clinically but some need x-ray examination for diagnosis. Presence of cheiroarthropathy, frozen shoulder, dupuytren's contracture, trigger finger was observed in diabetic patient<sup>5,8,9,10</sup>. Functional loss starts in a very early stage of type 2 diabetes mellitus and in later stage diabetic polyneuropathy might accelerate reduction in muscle strength. Small muscle wasting of hand in diabetes is bilaterally symmetrical and involves the of thenar and hypothenar Atrophy is most noticeable in first dorsal interossei with loss of normal rounded appearance. Posture of the thumb is altered with increasing muscle weakness.

**Jamar Dynamometer<sup>11</sup>:** It is an instrument for measuring the maximum isometric strength of hand and forearm muscles. It was introduced in 1954 (bechtol;1954). It consists of a sealed hydraulic system with adjustable hand spacing that measures handgrip force. The dynamometer is used for testing hand grip strength and tracking progress with strength training and during rehabilitation

**Contrast Bath:** Also known as “Hot Cold Immersion Therapy” is a treatment in which limb is immersed in warm water followed by immediate immersion in cold water. Procedure is repeated several times. Treatment is ended with hot water. Physiological effects of contrast bath include vasodilatation and vasoconstriction at regular intervals. It leads to reduction in oedema and is beneficial in various chronic peripheral circulatory disturbance.

### **Need of Study**

In clinical practice commonly the grip strength is assessed while assessing the hand function of diabetic individual. The grip strength strongly influence the hand function which in turn can affect the functional capacity in a diabetic patient. There are various studies done to check the effect of heat and cold individually on grip strength. There are various which concludes that grip strength is reduced in diabetic patient.<sup>4</sup> To our knowledge there are few studies available to study the effect of contrast bath on grip strength. Physiological effects of contrast bath show reduction in oedema and is beneficial in chronic peripheral circulatory disturbance relieves stiffness and hence this study is conducted to see whether these effects can help to improve the grip strength in diabetic patients.

### **Aim and Objectives**

#### **Aim**

To study the effect of contrast bath on grip strength in type II Diabetic patients

#### **Objectives**

To check the grip strength before applying contrast bath in type II Diabetic patients

To assess the grip strength following contrast bath in type II Diabetic patients

### **Review of Literature**

1. The Korean Sarcopenic Obesity Study (KSOS) included 810 subjects (414 patients with diabetes and 396 control) who were examined using dual xray absorptiometry. Prevalence of sarcopenia was defined using the skeletal muscle index (SMI) which concluded that type 2 diabetes was associated with increased risk of sarcopenia
2. A Cross sectional study was conducted by Barki S Khan HM, Jilani SM, Nooruddin M in 2013 on 375 diabetic patients above 35 years of age with a history of minimum 5 years of disease which revealed the most common manifestations were osteoarthritis affecting both the extremities, frozen, and fibromyalgia noted in both type of diabetes
3. Savas, S, Koroglu BK, Koyuncuoglu HR, Uzar E Celik H, Tamer NM conducted a study on 44 type 2 diabetic patients and control who were examined for presence of Dupuytren's disease trigger finger and LJM. Grip strength was assessed using jamar dynamometer followed by a pinch strength measurement using a manual pinchmeter. Electrophysiological studies were performed in both the groups. Duroz hand index was used to assess the functional hand disability. The study concluded that Dupuytren's disease trigger finger and LJM did not cause any functional disability to hand but reduced grip strength was found to be the cause of hand disability in type 2 diabetic patients
4. Sayer AA, Dennison EM, Syddall HE, Gilbody HJ, Phillips DI, Cooper C. Conducted a cross sectional study

on 1391 men and women aged between 60-70 years information was obtained regarding grip strength using a jamar dynamometer, physical function using SF-36 questionnaire. The study revealed that diabetes status was associated with significantly reduced grip strength particularly in men leading to poor muscle strength along with impaired physical function than those without diabetes.

5. Kalyani RR, Metter EJ, Egan J conducted a study in 2015 on 984 subjects aged 25-96 HbA1c, knee extensor strength and lean body mass measured at the baseline. Participants had repeated measurements upto 7.5 years later. Muscle quality was defined as knee extensor strength/leg lean mass. The study concluded that hyperglycaemia is associated with persistently lower muscle strength with ageing.
6. Stanton DE, Lazaro R, Mac Dermid JC conducted a study in 2009 to examine the nature and quality of evidence regarding the use of contrast baths. In the study subject included normal/control group, patients with a diagnosis of RA, diabetes, or foot/ankle injuries the study revealed that contrast bath may increase the superficial blood flow and skin temperature.
7. Mete T, Aydin Y, Saka M, Cinar Yavuz H, Bilen S, Yalcin Y, Arli B, Berker D, Guler S conducted a study in 2009 to compare the effectiveness of MNSI, neurothesiometer, and electromyography in patients with diabetes for detecting diabetic peripheral neuropathy which included 106 patients with type 2 diabetes. Patients were evaluated by glycemic regulation test, MNSI, EMG and neurothesiometer which concluded that questionnaires and physical examination often present lower diabetic peripheral neuropathy.

### **Hypothesis**

#### **Experimental Hypothesis**

There will be significant difference in grip strength in type II Diabetic patient following contrast bath.

#### **Null Hypothesis**

There will be no significant difference in grip strength in type II Diabetic patient following contrast bath.

### **Material and Methodology**

#### **Study Design**

- Type of study : experimental
- Duration of study : 1 Year
- Location: Metropolitan City.

#### **Sample Design**

- Sample size : 50
- Sample population : type II diabetes patient
- Sampling : convenient

### **MATERIALS**

- Container containing cold water
- Container containing hot water
- Jamar dynamometer
- Thermometer
- Towel
- Chair
- Table

**Selection Criteria**

**Inclusion Criteria**

- Type II diabetic patient willing to participate.
- Type II diabetic patient with diabetes for at least 5 to 7 years.
- Patients with physical examination score of <2.5 in Michigan neuropathy screening instrument.<sup>15,16,17,18</sup>

**Exclusion Criteria**

- Any nerve injuries in hand.
- Recent fractures related to hand.
- Sensory impairments in hand.
- Congenital deformities in hand
- Allergy to cold
- Soft tissue injuries in upper limb
- Smokers
- Individuals unable to follow the command

**Procedure**

- Screening of subject as per the inclusion criteria.
- Procedure will be explained to the subject in detail
- A written consent will be taken from the subject in the language best understood by them
- The individual will be made to sit on a chair with arm resting on the table A 15-item questionnaire form of MNSI will be applied to all the patients to rule out diabetic neuropathy
- Grip strength will be measured using a hand held dynamometer and the findings will be noted.
- Two suitably sized bath will be filled the hot water should be at 40-45 degree celcius and cold at 15-20 degree celcius.
- The period of immersion in hot water is about 3 minutes where that in cold water is 1 minutes<sup>19</sup>. The cycle will be repeated 4-5 times. Grip strength will be measured again and difference between the two grip strength will be noted. Final data will be analysed.



Jamar Dynamometer

Thermometer



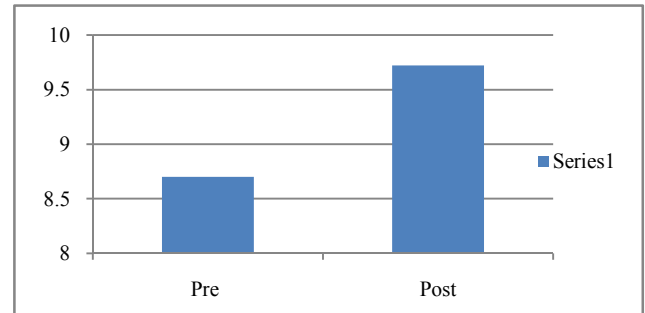
Container Containing Cold Water

Container Containing Hot Water

**TABLE AND RESULTS**

**Data Analysis**

Comparison between pre and post grip strength in type 2 diabetic patients followed by application of contrast bath



	MEAN	SD
PRE	8.70	1.25
POST	9.72	1.60

**Inference:** The above graph states that there is significant difference between pre and post readings of grip strength

**Master Chart**

Sr no.	Pre	Post
1	8	9
2	11	12
3	10	10
4	9	10
5	11	12
6	10	12
7	7	8
8	9	9
9	8	7
10	7	8
11	8	8
12	10	11
13	8	9
14	7	7
15	9	11
16	8	9
17	8	8
18	11	13
19	10	11
20	9	10
21	9	10
22	10	11
25	8	8
26	10	12
27	8	10
28	7	8
29	9	11
30	11	12
31	9	10
32	7	7
33	8	7
34	10	12
35	9	10
36	9	11
37	7	8
38	8	8
39	10	11
40	8	9
41	8	9
42	9	9
43	8	10
44	7	8
45	8	9
46	7	9
47	8	10
48	9	10
49	10	12
50	8	10

## DISCUSSION

50 patients with type 2 diabetes were selected based on the selection criteria. Grip strength was assessed with Jamar dynamometer followed by contrast bath. Grip strength was reassessed after application of contrast bath. The data collected was statistically analyzed using a paired “t” test.

The tables and graphs were interpreted and the results showed that there is a significant difference in grip strength in type 2 diabetic patients followed by application of contrast bath with a p value less than 0.0001.

Thus the following study shows that grip strength is improved followed by application of contrast bath in type 2 diabetic patients.

The possible reason for increase in grip strength followed by contrast bath are the physiological changes in the tissues caused by alternate vasodilation and vasoconstriction.<sup>12,13,14</sup>

Myrer.*et.al* (1994) proposed that contrast bath is reported to produce physiological effects of vasodilation and vasoconstriction of local blood vessels, changes in the blood flow, reduction in swelling, reduction in inflammation and muscle spasm.

According to Calder (1996) contrast bath is thought to speed the recovery by increasing the peripheral circulation and by removal of metabolic waste. Further he claimed that contrast bath increases lactate clearance enhances blood flow to the fatigued muscles and reduces post exercise oedema.

A study conducted by A Mooventhan and L Nivethitha to check scientific evidence based effects of hydrotherapy on various systems of body suggest that contrast bath reduces pain, hand volume and stiffness in the affected extremities .

## CONCLUSION

The study concludes that contrast bath is beneficial in improving grip strength in type 2 diabetic patients.

## CLINICAL IMPLICATION

Thus contrast bath can be used for improving grip strength in type 2 diabetic patients

### Limitation and Suggestion

#### Limitation

- small sample size
- also long term effects of contrast bath on grip strength are not known

#### Suggestion

- long term effects of contrast bath can be checked
- also sample size can be increased

Along with contrast bath grip strengthening exercises can also be added

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