Abstract : Recently, reduced hand strength is recognized as a complication of type II diabetes. Hand grip strength is an important parameter to evaluate the power of the hand. This study was done to assess the hand grip strength in type II diabetics and also to compare it between diabetics and healthy males and females. This study was conducted on 40 type II diabetics of age group 35-50 years with duration of diabetes 5-10 years and 40 healthy controls of same age group. Hand grip strength testing was done in all subjects using Handgrip Dynamometer and the results were analyzed statistically using students t test. Statistically significant difference was found in hand grip strength between type II diabetics and healthy controls. Similarly the values of handgrip measurements were reduced in diabetic males and females when compared with the healthy males and females. This proves that type II diabetics have reduced hand grip strength in both male and female subjects. This physical limitation results in low productivity in people with type II diabetics. Hence, strict glycemic control and regular resistance exercise is recommended to improve the hand muscle strength.

Keyword : Type II diabetes, Hand grip strength, Hand grip dynamometer

Introduction: Type II diabetes is the most common form of diabetes and is currently a major worldwide cause of morbidity and mortality (1). It is a chronic metabolic disease characterized by hyperglycemia resulting from insulin resistance and inadequate insulin secretion (2). Chronic hyperglycemia leads to complications such as cardiovascular disease, peripheral vascular disease, retinopathy, nephropathy, neuropathy and loss of physical function. Other complications are decline in muscular strength and reduced exercise capacity (3). Adequate muscle strength is essential for physical functioning and low muscle strength is a predictor of physical limitations (4). The individuals with type II diabetes have increased risk of developing functional disabilities. Hand grip strength is a reliable measurement of the disability index (5). Hand grip strength testing by dynamometer is a simple, non-invasive method of examining muscle strength of upper extremities. It reflects the maximum strength derived from combined contraction of extrinsic and intrinsic hand muscles which leads to the flexion of hand joints (6). It is an isometric strength testing where maximum force is produced against an immovable resistance (7).

It is commonly used to evaluate the integrated performances of hand muscles by determining maximal grip force that could be produced in one muscular contraction. It is a marker for general muscle strength (8). Since hand disability was found to have an adverse impact on the daily activities in diabetics, this study was conducted to assess the hand grip strength in type II diabetes.

Aim and Objectives: 1. To study the effect of type II diabetes on hand grip strength using hand grip dynamometer. 2. To compare the hand grip strength between the diabetic males and females and the healthy males and females

Materials and Methods: The study was approved by the institutional ethical committee and all the subjects gave written informed consent prior to the participation. The study was done from June to November 2012. 40 type II diabetics were selected from the diabetic outpatient department of age group 35-50 years with duration of diabetes 5-10 years. 40 healthy controls of same age group were selected from those who accompanied the patients attending the general out patient. Of the 40 diabetics and 40 healthy controls, 20 were males and 20 were females. Subjects with cardiopulmonary disease, neuromuscular and orthopedic disorders like with H/o trauma or cervical radiculopathy or hand related pain were excluded from the study. Diabetes was diagnosed according to American Diabetes Association Diagnostic Criteria as follows: Fasting plasma glucose 126 mg/dl and post prandial plasma glucose 200 mg/dl.

At the beginning of the study, Demographic data like age, sex, height and weight were obtained and recorded. Thorough clinical examination and history was obtained from the subjects in order to determine the health status of the individual. Hand dominance was determined by the questionnaire such as preferred hand to comb the hair, writing, eating etc. The measurement of hand grip strength in the dominant hand was done by using Handgrip Dynamometer (Labotech Precision Instruments) which is a portable instrument in which the maximum isometric tension achieved can be directly read from the reading on the dial. The value is read in kilograms of force.

Figure: 1 HAND GRIP DYNAMOMETER
The American Society of Hand Therapists recommendations for testing hand grip were followed. The test was first demonstrated to the subjects and by allowing one trial the subjects were familiarized with the instrument. Subjects were seated comfortably on the chair without armrests and their back straight. The shoulder was adducted and neutrally rotated, with the elbow at 90° flexion, and the forearm and wrist in a neutral position. Each subject was instructed to squeeze the handle of the dynamometer, which was placed vertically in their hands, as hard as possible. The period of the effort did not exceed 5 seconds. The Maximum isometric tension produced is measured. A period of 1 minute rest was given between the trials. The best of the three recordings was taken as maximum isometric tension for that hand and the values were tabulated. Data were presented as mean and standard deviation and analyzed using Student’s t test. It was used to assess the significance of hand grip strength between the diabetic group and control group. P value less than 0.05 was taken as statistically significant.

RESULTS:
Out of 80 subjects, 40 were type II diabetics (20 males and 20 females) and 40 were controls (20 males and 20 females).

TABLE: 1
Anthropometric parameters for the controls and diabetics.

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>CONTROL GROUP (n=40) (Mean ± SD)</th>
<th>DIABETIC GROUP (n=40) (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE (yrs)</td>
<td>41.5±4.45</td>
<td>48.2±4.41</td>
</tr>
<tr>
<td>HEIGHT (cm)</td>
<td>154.3±15.9</td>
<td>149.5±13.3</td>
</tr>
<tr>
<td>WEIGHT (kg)</td>
<td>63.17±5.42</td>
<td>67.07±5.95</td>
</tr>
<tr>
<td>BM (kg/m²)</td>
<td>21.30±1.48</td>
<td>24.5±5.17</td>
</tr>
</tbody>
</table>

The anthropometric parameters for the control and diabetic groups were compared. (*P value <0.05 was considered as significant) The hand grip strength of dominant hand is compared between the diabetics and controls. The mean (±SD) value of handgrip strength in control group is 23.25±5.49 and for the diabetic group is 18.45±6.84. The hand grip strength is reduced in diabetics when compared to controls of same group and was found to be statistically significant (P = 0.001).

DISCUSSION:
Diabetes is a leading cause of functional impairment and death due to accompanying complication. Inspite of developments in management, Type II diabetes remains a serious health problem. There is change in body composition and exercise capacity due to insulin resistance, which characterize type II diabetes (8). Recently, reduced hand strength is beginning to be recognized as a further complication of diabetes (9). Hand strength depends on a patient’s age, sex, hand dominance, occupation, body weight and height, position of the wrist, elbow and shoulder (10). It is also a predictor of bone mass and a marker of nutritional status (10). The present study showed reduced hand grip strength in diabetics with duration of diabetes 5-10 years when compared with healthy controls. Similar results were shown in the study conducted by E.Četinuš et al (11). Ezema et al and Andersen et al observed (11). They explained the risk of upper limb functional limitations in older individuals with long standing type II diabetes. The underlying mechanism for poor muscle function may be the subclinical neuropathic process involving motor neurons (8). Sayer et al demonstrated that lower grip strength is a marker of sarcopenia and is associated with type II diabetes (12). They explained that weaker muscles tend to be smaller and therefore have potential for reduced glucose uptake and hyperglycemia, since the GLUT4 expression at the plasma membrane is related to fiber volume in human skeletal muscle fibers. Hyperglycemia affects the contractile function.
and force generation in muscle (12). Prolonged hyperglycemia results in glycation of myosin, the molecular motor protein in skeletal muscle that converts chemical energy into mechanical work (13). Savas et al observed that hand disability was associated with reduced hand strength, but not with the three conditions (limited joint mobility, dupuytren’s contracture and trigger finger) traditionally described as diabetic hand (14). Gender is the most important factor affecting hand grip strength (1). It was found that males hand grip strength was stronger than females. In this study the hand grip strength is reduced and showed significant differences between the male diabetics and the male controls, as well as between the female diabetics and the female controls and the reduction was more in females. Similar results were observed in Ezema et al (5) and S.W Park and associates (3) study. The difference in muscle strength can be explained by the difference in skeletal muscle mass and the women showed poor physical function suggesting that their strength might be insufficient to carry heavy weight (5).

CONCLUSION:
Hand grip strength is reduced in type II diabetics when compared to healthy controls. It is also lower in diabetic males and females when compared with healthy males and females. These characteristics may contribute to development of hand disability in subjects with diabetes which affect the daily life activities. So good glycemic control and regular resistance exercise such as weightlifting should be encouraged which counteracts the decrease in skeletal muscle mass and strength (15).

REFERENCES: