ABSTRACT

Background: Type 2 Diabetes Mellitus commonly affects the elderly individuals. Reduced muscle strength has been considered as one of the complications of Type 2 Diabetes Mellitus. Handgrip strength is an important parameter to evaluate the power of the hand. Handgrip strength has also proven to be an important measure to diagnose muscle degeneration at an early stage. The study aimed to compare the hand grip strength between individuals with and without type 2 diabetes mellitus.

Methods: This comparative cross-sectional study was conducted in the Outpatient Department of Medicine, Kathmandu Medical College and Teaching Hospital. In total 200 subjects who met inclusion criteria participated in the study. Handgrip strength was measured with an isometric hand dynamometer and comparisons were made between diabetic and non-diabetic groups. Independent t-test were used to analyze the significance difference in hand grip strength between the two groups (p=0.05).

Results: Total of 200 subjects (100 T2DM and 100 controls) were studied. Mean hand grip strength (kg) was significantly lower both in men and women with diabetes compared with controls (37.54±6.08 vs 45.16±4.82, p = 0.000 in men and 33.97±6.47 vs 44.54±5.42, p = 0.000 in women).

Conclusions: Hand Grip Strength was significantly lower in subjects with type 2 diabetes mellitus subjects when compared with healthy volunteers.

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) commonly affects the elderly individuals. It is a chronic metabolic disease characterized by persistent hyperglycemia, insulin resistance and increased advanced glycation end products (AGEs). Recent studies have shown that T2DM is associated with reduced muscle strength and quality leading to physical disability. Hand is one of the organs that is primarily affected and is accompanied by impaired hand function and discomfort to the diabetic patients. Reduced handgrip strength is observed in elderly T2DM patients, attributed to decreased muscle mass and strength. Adequate muscle strength is needed to self-care task and decreased strength suggests compromised daily activity.

Handgrip strength (HGS) is an important parameter to evaluate the power of the hand. It is the maximum power developed after forceful voluntary contraction of all fingers. Amount of static force that the hand produces on squeezing a dynamometer gives the measurement of hand grip strength. Grip strength measurement helps to assess the function and to regain the strength of upper limbs. Thus, our aim in this study was to compare the hand grip strength between healthy individuals and T2DM patients.

METHODS

This comparative cross-sectional study was conducted in the Out Patient Department of Medicine, Kathmandu Medical College and Teaching Hospital. Ethical Clearance (ref:100420181) was obtained from Institutional Research Committee of the same institute. 100 T2DM subjects aged between 40-70 years who had diabetes for more than 5 years and 100 apparently healthy volunteers aged between 40-70 years were included for the study. The included subjects had no glucose intolerance, no history of pain, no musculoskeletal problems, no history of trauma in the previous 6 months. None of the participants was involved in occupation that requires manual handling that can influence the handgrip. Written informed consent was obtained. Weight and height were recorded and BMI was calculated using Quelet’s formula; BMI (Kg/m2) = Wt. (Kg)/Ht2.
(m). Hand Grip Strength was measured on Dominant Hand using Hand Dynamometer. The subject was seated in a straight back chair with their feet flat on floor. The shoulder was adducted and neutrally rotated, elbow flexed at 90 degrees, forearm in neutral position with the wrist between 0–30 degrees extension and between 0–15 degrees ulnar deviation. The participants were instructed to squeeze the handle as hard as possible for maximum of 5 seconds. A period of 30 seconds rest was given between three trials for the dominant hand to be tested and the average of the three trials was taken. Highest recording was considered for the study.

Mean and standard deviations were calculated for the baseline measurement for each participant. Independent sample t-test was used to assess the significance in the difference between handgrip strength among the different groups. Data analysis was done using SPSS version 25. P-value of <0.05 was considered significant.

RESULTS

The total number of participants in our study were 200. Among them 100 were type II diabetic patients and 100 were healthy volunteers. The number of male participants were 78(39%) and female were 122(61%). Male participants with type II diabetes were 36(46.2%) and type II diabetic female participants were 64(52.5%). The number of male participants without type II diabetes were 42(53.8%) and females were 58(47.5%). The demographic characteristics of the subjects are shown in table 1. The mean age of the subject in male diabetic group is 54.53±7.16 and male non-diabetic group is 50.19±7.68 and the mean age of the subject in female diabetic group is 54.13±7.75 and female non-diabetic group is 53.60±7.97. The mean BMI in male diabetic group is 23.24±2.08 and male non-diabetic group is 23.94±1.48 and the mean BMI in female diabetic group is 22.67±2.22 and female non-diabetic group is 21.68±2.06. 

The statistical analysis of hand grip strength in diabetic and non-diabetic group are shown in table 2. The mean hand grip strength in diabetic male is 37.54±6.08 and non-diabetic male is 45.16±4.82. Similarly, the mean hand grip strength in diabetic female is 33.97±6.47 and 44.54±5.42 in non-diabetic female subjects. The independent t-test analysis showed that there was a significant difference between the mean handgrip strength of the male diabetic group and non-diabetic group (p=0.000) and mean handgrip strength of the female diabetic group and non-diabetic group (p=0.000).

DISCUSSION

This study demonstrated reduced hand grip strength in T2DM subjects with duration >6 years when compared with non-diabetic groups. Both men and women with T2DM had significantly lower HGS compared with subjects without diabetes. In last few decades, many studies have documented impaired muscle strength and poor muscle function in subjects with diabetes. The results of this study are in accordance with other studies stating that T2DM has deteriorating effect on hand grip strength resulting in reduced upper limb muscle strength and quality. The Health, Aging, and Body Composition Study showed reduced muscle strength in diabetic male despite of having greater muscle mass than non-diabetic male. Kaur et al demonstrated significantly lower hand grip strength in T2DM patients. Similar results were shown in the study conducted by E. cetinus et al, Ezema et al, Andersen et al and Park et al. Reduced muscle strength in the upper limb in elderly may be due to the subclinical neuropathic process involving motor neurons. Helmersson et al attributed the reduction in muscle strength in T2DM to insulin resistance and hyperglycemia, which reduces the number of mitochondria in the muscle cells, decreases glycogen synthesis and an increases the amount of circulating systemic inflammatory cytokines. Reduction in skeletal muscle strength can also be due to glycosylation of skeletal muscle proteins, actin and myosin. Gender is one of the most important factor affecting hand grip strength. Our study found that hand grip strength of males was higher than females in both diabetic and non-diabetic groups. Study done by Crosby et al. and Balogun et al. also documented higher handgrip strength in diabetic males than diabetic females. This difference in handgrip strength may be because of differences in muscle mass, body size, and other factors.
in body composition, hormones and size of the muscle fibre between males and females.

Multivariate logistic regression analysis considered diabetes as an independent risk factor for low HGS in both men and women. Our study is one of the few studies to examine muscle strength in subjects with or without T2DM. Muscle strength is now recognized better than muscle mass in predicting adverse outcomes. 11,12

This is a cross sectional study showing only an association between type 2 diabetes and impaired muscle strength. We did not see the effect of antidiabetic drugs on muscle mass and strength. We did not measure muscle mass. There is evidence to suggest that muscle strength does not depend solely on muscle mass, and the relationship between strength and mass is not linear. 8,13 Despite these limitations, the results of our study have important implications. Adults with diabetes are at increased risk of developing physical disability due to reduced muscle strength. The lowered muscle strength in diabetic patients is suggestive of sarcopenia and therefore it needs to be studied whether exercise, including resistance training, along with adequate dietary protein intake and tight glucose control could modify or prevent sarcopenia in T2DM subjects.

CONCLUSION

In conclusion, the present study showed that subjects with diabetes had significantly reduced handgrip strength compared with those without diabetes. Furthermore, T2DM was independently associated with increased risk of reduced HGS both in men and women after adjusting for potential risk factors.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

REFERENCES:


