CHAPTER V

DISCUSSION

The present study showed that the average the 6MWD in men with type 2 DM was 496.88m. HRim and peak torque of knee flexor were significantly correlated with 6MWD and could explained 33.7% and 30.1% of the variance in the 6MWD, respectively.

The 6MWD of subjects with type 2 DM in this study was comparable to the distance (496.88 ± 62.11 vs. 492.1 ± 89.5 m.) reported by Ozdirenc et al (2003)(19). Additionally, the age of the patients in this study is similar to Caucasian healthy subjects (19) and healthy Asian subjects (67) (60.55 ± 5.59 vs. 56.6 ±. 6.4 vs. 61.8 ± 8.3 years, respectively). Regardless of ethnicity, lower 6MWD in type 2 DM patients was found when it was compared to healthy subjects (496.88 ± 62.11 vs. 578.9 ± 40.2 vs. 560 ± 105m, respectively) (19, 67). Therefore, the reduction in 6MWD in patients with type 2 DM may be independent to demographic data.

The 6MWT can indirectly determine exercise capacity and reflect changes in functional activity. In previous study, the functional exercise capacity and functional activities in individuals with type 2 DM were lower than healthy individuals (13-17). As the results, the 6MWD in this study may reflect a reducing functional exercise capacity in subjects with type 2 DM.

The duration of diabetes diagnosis in this study was between 5 and 19 years. Normally, the vascular complication seems to positively relate with the length of disease diagnosis (13, 14). The subjects' fasting glucose level was 134.18 ± 19.89 mg/dl considering as a hyperglycemia. Previous studies found that hyperglycemia was the importance risk factor for macrovascular complications and had impact on functional activities (4, 33, 68, 69). Thus, the diminished functional exercise capacity in subjects with type 2 DM may be associated with duration of disease diagnosis and hyperglycemia.

It is obvious that the ventilatory pump function of subjects' PFTs in this study were preserved. These results are in agreement with Benbassat et al (2001) (8) and Melo et al (2003) (9) who reported that PFTs were not reduced in type 2 DM group when compared to the normal group. In contrast, Davis and colleagues (2004) (7) found that PFTs were decreased in patients with type 2 DM. It may be explained that only subjects with normal lung function were recruited in this study. Thus the impact of the ventilatory pump impairment is not showed.

The reduction of muscle strength reflects an impairment of musculoskeletal system. In previous study, Andersen and colleagues (2004) (12) found that maximal isokinetic muscle strength of knee and ankle muscle in patients with type 2 DM was significantly reduced as compared with normal subjects. In this study, maximal isokinetic muscle strength of knee and ankle muscle in subjects with type 2 DM was lower than Caucasian normal subjects (70).

In addition, the ratio of maximal knee flexion strength relative to maximal isokinetic knee extension strength (HQ ratio) is a parameter commonly used to describe the muscle stability of knee joint (71). Previous studies found that the optimal HQ ratios were 50-80% (72, 73). In this study, the HQ ratios of subjects with type 2 DM were about 60%. These HQ ratios were within normal limits, but toward to the lower boundary. Since the reduction of the knee extensor is minimal, the low

HQ ratio in this study is more likely due to the deterioration of knee flexor strength than the knee extensor strength.

Most previous studies found that demographic data (age, weight, height, and BMI) could contribute to 6MWD in healthy population (50, 51, 53, 58, 67, 74). However, this may not be the case in patients with type 2 DM since the significant correlation between demographic data and the 6MWD was not found.

In this study, significant correlation between the 6MWD and HRim (r = 0.635, p < 0.05) in subjects with type 2 DM was found. This was similar to the previous study (67) reporting that the percentage of the predicted maximum heart rate (%predHRmax) was related to 6MWD (r = 0.73 p < 0.001) in healthy Singaporean subjects. HRim and %predHRmax could explain 33.7% and 53% of variance in the 6MWD, respectively

Currently, there is no literature showed the correlation between the pulmonary impairment and the 6MWD in patients with type 2 DM. In this study, the PFTs (FVC, FEV_1, FVC/ FEV_1, pred FVC, pred FEV_1) were not statistically significant correlated with the 6MWD. As mentioned above, the PFTs are within normal limit. Thus, the relationship between the 6MWD and the PFTs was not or poorly developed. This agrees with Camarri et al (2006) (74). They found that FEV_1 was fairly related with the 6MWD (r = 0.48, p < 0.001) in healthy subjects aged 55-75 years. This variable could explain 4.5% of the variance in the 6MWD. Consequently, the pulmonary system rarely contributes to the 6MWD in subjects with type 2 DM if their lung function is normal.

Lower extremity physical functions such as walking, stair climbing and sit to stand are impaired in type 2 DM patients (14, 16, 17). In this study, the impairment of musculoskeletal system is represented by muscle strength measuring as peak torque. There was a significant relationship between peak torque of knee flexor and 6MWD (r = 0.609, $p < 0.05$) while the others (peak torque of knee extensor, ankle dorsiflexor and ankle plantar flexor) were not significantly correlated with 6MWD. Previous study also reported that isokinetic muscle strength of knee flexor and knee extensor muscle was reduced by 14% and 7%, respectively (12). Thus, the knee flexor muscle is more likely to contribute to the 6MWD than knee extensor muscle.

The equations for estimated the 6MWD in this study could be explained by 33.7% HRim ($p < 0.05$) and 30.1%, peak torque of knee flexor ($p < 0.05$) of variance in 6MWD. In contrast, the demographic data could explain variance in the 6MWD between 26% and 66% in healthy population (50, 51, 58, 67, 74). This may be because in patient population, the affected systems are more likely to contribute to the 6MWD than the demographic data.

For application, results from this study found that impairment of cardiovascular system indicated by HRim and musculoskeletal system indicated by peak torque specifically knee flexor contributes to the reduction of functional capacity indicated by 6MWD in patients with type 2 DM. According to the results, it may imply that the rehabilitation in cardiovascular and musculoskeletal system should be emphasized in patients with type 2 DM.

Generalization in this study is limited. This is because only male subjects with age between 52 and 67 years were recruited into this study. Future study may focus on female patients with type 2 DM and wide range of age group should be involved. In addition, fasting blood glucose should be concentrated since the disease severity may affect to the 6MWD in patient with type 2 DM. Thus, the correlation between 6MWD and the fasting glucose level should be determined.

In conclusion, the 6MWD in patients with type 2 DM was significantly correlated with HRim and peak torque of knee flexor. There were no statistically significant correlations among the 6MWD with demographic data, PFTs, and muscle strength of lower extremity except knee flexor muscle. The 33.7% and 30.1% of the 6MWD could be explained by HRim and peak torque of knee flexor in male patients with type 2 DM.