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REVERSING TYPE 2 DIABETES BY WEIGHT LOSS

Obesity is strongly associated with insulin resistance and the development of Type 2 diabetes and exercise seems to have a preventive effect. There are many sports where size matters. Athletes such as shot-putters, sumo wrestlers, weightlifters and American football players are usually huge and obese but they remained healthy and very few of them suffer from insulin resistance. The one big difference from the non-athletic overweight individuals lies in the fact that these athletes have very low levels of visceral fat and higher levels of muscle mass.

Fat is stored under the skin (subcutaneous fat) or around the organs (visceral fat). One can look slim with low level of subcutaneous fat but unhealthy with high level of visceral fat or look fat with high level of subcutaneous fat but healthy with low level of visceral fat. Visceral fat has been thought to be highly related to insulin resistance and it is believed that reducing visceral fat may reverse diabetes. Interestingly, it was shown that Type 2 diabetes can be reversed by losing just 1g of fat in the pancreas (Roy Taylor, 2016).

Studies by Dr Roy Taylor of Newcastle University had demonstrated that through a strict 600 to 700 Calories diet, patients with up to 10 years of Type 2 diabetes who managed to lose enough weight to remove fat out of the pancreas had regained normal insulin production even though the patients may still remain overweight or obese. The researcher believed that excessive fat in the pancreas is specific to Type 2 diabetes as fat deposition reduces the pancreas' ability to secret insulin. However, he does agree that the amount of excess fat in the pancreas a person can tolerate before becoming diabetic is very individual.

Through MRI scan, researchers exhibited that people with Type 2 diabetes were usually found with abnormally high level of fat buildup in the pancreas as compared to other obese individuals without diabetes. The research compares healthy obese individuals with obese individuals with Type 2 diabetes who managed to lose weight.

They found that individuals without diabetes did not show any change in pancreas fat while those with diabetes who managed to lose an average of 1.2g of fat from the organ had their insulin secretion returns to normal and become diabetes free.

However, it is not as easy as losing body weight to lose that 1g of fat from the pancreas. We cannot select which part of the body to lose fat and we still do not know how much body weight to lose to remove 1g of fat from the pancreas. Existing data shows losing an average of about 10% of body weight can see some effects. However, the good news is that appropriate exercise enhances the mobilization of visceral fats as a fuel source for energy production. Moreover, losing weight through exercise has more benefits such as cardiovascular health and sustainability than just diet alone.

Exercise expends energy and in conjunction with dietary control, it induces deficit calories leading to weight loss. Current trends point towards high intensity interval training for better results and time efficient. Systematic review on earlier researches had shown that aerobic exercises were more effective in inducing visceral fat loss than resistance training (Ismail et al., 2011).

Studies (Bateman et al., 2011; Ho et al., 2012; Paoli et al., 2013) combined traditional protocols of aerobic plus weight training and produced moderate weight loss (~-3.5%) and waist and hip reduction (~2.5%) in overweight individuals after 12 weeks of exercise intervention. Coker and colleagues (2009) found that higher intensity aerobic exercise was more effective in reducing abdominal fat in elderly adults regardless of weight loss. Later studies (Lee et al., 2012, Zhang et al., 2015) applied high intensity interval training and reported a higher success in weight loss (-4% to -8%) and waist and hip reduction (-4 to -6%) after 12 to 14 weeks of training. However, HIIT for non-trained individuals can be difficult, less tolerable, and less affective especially to the older folks (Boutcher, 2011).

Recently, more research interest and emphasize on resistance or strength training has been observed. Strength training was documented to play an important role in the management and treatment of diabetes (ADA, 2012). Resistance training has also been shown to improve hepatic insulin sensitivity while aerobic training improves peripheral insulin sensitivity only (Gert-Jan van der Heijden et al., 2010). More training ideas and protocols with the integration of strength training combined with aerobic and anaerobic components has been designed and promoted aiming to provide a more enjoyable and yet effective training system.

HIGH INTENSITY FUNCTIONAL TRAINING

One of the examples of this type of training system is Crossfit®. Some researchers called this type of training as high intensity functional training (HIFT). It is believed that it is able to improve cardiovascular fitness and functional strength while reducing training durations by more than 50%. Babiash and colleagues (2013) measured the calories expenditure of two Crossfit® exercises named FRAN and DONKEY KONG and recorded approximately 169.6 Calories burned in about eight minutes for men and 117.2 Calories expended in about nine minutes for women. This is equivalent to about 2.5km or 30 minutes of brisk walking. Heinrich and colleagues (2015) then demonstrated an impressive 15% reduction of fat mass after just five weeks of HIFT in cancer survivors.

Crossfit® exercises are mainly complex gymnastic movements and power exercises involving heavy weights. In my recent study (Loh, 2017), I modified the exercises to make it more tolerable and doable for the less athletic obese individuals and observed the results. Six middle-aged obese patients (three male and three female, average age of 44) were recruited for the study. They performed a modified version of the high intensity functional training (HIFT), three times per week for an average of about 30 minutes each session for four weeks.

Participants were asked to maintain their current diet. The training consists of exercises such as power clean and snatch exercises, lunges, squats, sit-ups and kettlebell swings in performed in 10 minutes bout with periodic intervals in between sets (Figure 1). Participants were told to select manageable weights and take their time to complete the exercises. In the beginning, most participants require about 40 minutes to complete all exercises with rest intervals lasting as long as six minutes between stations.

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Around the fourth week, all participants were able to complete all exercises within 30 minutes with rest interval between stations as short as 60 seconds. Weights selected for the exercises also increased by 20% and they are able to run faster and further. Exercise effects on body composition after four weeks of training recorded a reduction of an average of about 2.2% of body weight and 5.4% of waistline with the highest waistline drop recorded at about 7.8cm. Participants remained highly motivated throughout the four weeks with no dropouts and over 95% attendance.

Overall, there is enough evidence showing the effects of exercise on abdominal fat and insulin resistance. Optimal results is observed in individuals who train both aerobic and anaerobically. Both energy system can be combined and trained concurrently in a training session. High intensity functional training can be safe and tolerable for beginners and those with chronic diseases when programmed appropriately. However, adequate mobility, stability and proper exercise techniques are essential before embarking onto this type of exercises routine.

	Monday	Wednesday	Friday	Remarks
	Morgan	**Wagon**	**Fred**	5 mins warmup • Foam roll • Stretch • movement prep 5 mins warmdown + stretching
1	**Clean, press (eMOM)** 8,8,8,8,8, (10 mins) clean + press dumbbell plank row (Score by time/set)	**Snatch, squat (eMOM)** 8,8,8,8,8, (10 mins) Dumbbell scissors crunch (Score by time/set)	**Deadlift (eMOM)** 8,8,8,8,8, (10 mins) Deadlift Barbell biceps curl (Score by time/set)	
2	10 mins AMRAP 15 air squats 10 kettlebell swings 5 machine seated chestpress (Score as many rounds)	10 mins AMRAP 4 rounds Treadmill 2-min run 30 secs walk (Score by distance)	10 mins AMRAP 15 back lunges 10 push ups 5 Kettlebell goblet squat (Score by rounds)	
3	1 Round 20 medicine ball situps 20 TRXrow Single leg bridge (Score by time)	1 Round 20 Double leg lowering 20 TRX push up 20 Side hip raise (Score by time)	1 Round 20 Oblique scissors crunch 20 TRX T-spine rotation 20 Mountain climbers (Score by time)	

Figure 1. Exercises and workout routine for the four- week study. There were three stations, each with a different set of circuit exercises and different type of scoring matrix. Between each station, there will be a passive rest period. Subjects can rest till they feel ready to move on to the next station. eMOM=every minute on the minute; AMRAP = As many repetitions as possible; AFAP = As fast as possible.

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