The effect of exercise health and social care essay

AbstractObjectiveThe objective of this Literature review is to assess the effect of exercise on T2DM in decreasing HbA1c. Abbreviations:(HbA1c): Glycosylated haemoglobin; (T2DM): type 2 diabetes mellitus; (RT): Resistance training; (WL): Weight loss; (NIDDM): Non-insulin dependent diabetes mellitus; (PRT): Progressive resistance training; (CWT): Circuit weight training; (WK): week; Research Design and MethodsThe method chosen for this inquiry was that of a meta-analysis. Several pieces of literature on this topic were acquired, reviewed, and analysed in order to draw conclusions on the matter. The hypothesis was that exercise will, in fact, lower the HbA1c levels within the diabetic research candidates. The null hypothesis is that no changes would be found. Significant data all credited the hypothesis, and there was in fact a cause and effect relation between exercise and the lowering of the HbA1c of individuals. This research design also allows for generalization of the results and conclusions derived, as there were numerous specimens of the population observed. Ten randomized controlled trials comparing well documented variable types of exercises such as aerobic, progressive weight resistance, cycling, walking with no exercise in people with T2DM. Trials were identified through different medical database such as Pub Med, Cochrane Central Register of Controlled Trials and the Jama network. Results: As stated, the results of this analysis were of overwhelmingly consistent results, which did prove to credit the hypothesis. Conclusions: Studies confirm that physical exercise significantly improves glycemic control.

INTRODUCTION

The topic chosen is the benefit of exercising for those with T2DM. I was overwhelmed with the number of patients with T2DM I encountered while practicing Family Medicine in Northern Manitoba. It is unfortunate to see the significant amount of people affected with T2DM. The more I learned about the disease and its implications in regards to a person’s general health, the more inclined I was to researching it further. It is very interesting how a change in lifestyle and the simplest physical activity can have a major impact on the metabolism and its entire function. For the scope of my paper I have researched different randomized control trials to allow a diversity of literatures and ideas. I kept focused on the benefits of exercising in patients with T2DM. The purpose of my paper is to explore the efficacy and benefit of exercising with patients suffering from T2DM. Promoting these results by sharing this useful information with the increasing population affected by the disease can lead to better quality of life for these individuals. T2DM is a metabolic disorder that is measured by increased blood glucose and characterized by impaired insulin secretion, insulin resistance, excessive hepatic glucose production, and abnormal fat metabolism. " In 2007, an estimated 23. 6 million people in the US had DM, of which T2DM makes up about 90% of cases." (McPhee & Papadakis, 2011) " This disorder is usually diagnosed in patients greater than thirty years of age, but it also occurs in children and adolescents. Most T2DM candidates are initially managed by increasing exercise and dietary modification. T2DM is commonly linked with obesity, and often presents itself after a period of weight gain. T2DM individuals with abdominal corpulence may have normal glucose level following weight loss". (Beers & Berkow, 1999). If blood glucose levels are

not sufficiently lowered, diabetic medication is needed such as oral medication or injectable insulin. Also genetic factors seem to be the major causes of the progress of the disease. HbA1c is blood drawn to estimate plasma glucose control during the preceding three (3) months. It is formed in a pathway by hemoglobin exposure to plasma glucose. Normal level for the healthy adult is about 6%. In poorly controlled diabetics, the level ranges from 9 to 12% (Beers & Berkow, 1999). " For the diabetic patient the goal of the therapy is 7. 0%. The diagnostic criterion for diabetes is greater than or equal to 6. 5%." (Horowitz)

REVIEW OF THE LITERATURE

1. The objective of this study by Dustan et al. (2002) is to evaluate the effect of high-intensity, progressive resistance training combined with moderate weight loss on glycemic control and body composition in older patients with type 2 diabetes. Thirty six Australians sedentary, overweight NIDDM, both genders, aging from 60 to 80 were randomized for this trial. The group was separated into a resistance training and weight loss group (RT and WL) and a weight loss (WL) group alone. Baseline HbA1c range from 7-10%. A six (6) month randomized controlled clinical trial performed three times per week. All participants were placed on a healthy eating plan intended to elicit a reasonable weight loss of 0. 25 kg/week, individually recommended by a dietician. The first group, RT (resistance training) and WL (weight loss), exercise consisted of 5 minutes warm up exercises, resistance training of low-intensity stationary cycling and 45 minutes of high-intensity resistance training (dynamic exercise) followed by 5 minutes cool-down. Also candidates followed an individually supervised progressive resistance

program: Nine exercises were used for training with free weights and multiple-station weight device. Training workload was increased regularly as tolerated after subjects had successfully achieved 3 sets of 10 repetitions. The control program (WL) weight loss was intended to offer participative involvement. Each session consisted of 30 minutes stationary cycling with no workload for 5 minutes followed by stretching movements. Twenty nine subjects successfully completed the trial, a drop-out rate of 19%. A decrease in HbA1c in the RT and WL of 0. 6% after 3 month of exercise and 1. 2% after 6 months. For the WL group a decrease in HbA1c of 0. 07% after 3 months of exercise and 0. 4% after 6 months. (Dustan et al., 2002)2. The aim of this study by Agurs-Collins, Kumanyika, Ten Have, and Adams-Campbell (2002) is to evaluate a weight loss and exercise program designed to improve diabetes management in older African-Americans. Sixty-four overweight African-Americans both genders from Washington, DC. Ages 55 to 79 years with NIDDM. The trial consisted of 2 groups, an intervention group and a control group. Baseline HbA1c was greater than 8%. A 6 months randomized controlled study consisting of promoting the intervention group to a diet to achieve a weight loss of at least 10 lbs. at a rate of no more than 2 lbs. per week and moderate physical activity sessions for a minimum of 3 days per week. The 90 minute session consisted of 60 minutes of nutrition education followed by 30 min of exercise which consisted of 5 min warm-up, 20 min of low-impact aerobic activity (treadmills, stationary bikes, and computerized rowing machines were available followed by 5 min of cool-down). The control group participated in one class, within 3 weeks of enrolment to discuss glycemic control and were mailed 2 nutrition information packages throughout the trial. Fifty five participants completed the trial. A decrease in

HbA1c in the Intervention group after 3 months of the study was calculated at -1. 6%, and after 6 months -2. 4%. The control group, HbA1c increased after 3 months to +0. 06%, and after 6 months + 1. 3%. The attained weight loss among the intervention group was less than the 4. 5 kg program objective (Agurs-Collins, Kumanyika, Ten Have, & Adams-Campbell, 2002). 3. The aim of this study by Balducci et al. (2010) is to evaluate the effectiveness of an intensive exercise intervention strategy on modifiable cardiovascular risk factors by prescribed and controlled aerobic and resistance training with organized exercise counselling and improving HbA1c level in patients with T2DM. Six hundred and six individuals from 22 diabetes clinics in Italy with T2DM, all associated with a metabolic fitness centre. Mean age of 60. Baseline HbA1c range from 7. 12% to 7. 15. Six hundred and six individuals were recruited and randomized and also introduced to supervised training exercise counselling for a 12 month period. The candidates were divided into 2 groups, a supervised exercise program consisted of 150 min/wk in 2 sessions of aerobic and resistance training. The aerobic training was performed using treadmill, step, elliptical, arm or cycle ergometer and the resistance training consisted of 4 resistance exercises such as chest press, lateral pull down, leg press, trunk flexion and stretching positions. The control group received exercise counselling alone, non-supervised. There was a dropout rate of 25% in the group. A significant decrease of 0. 42% in HbA1c in the supervised training exercise compared to a decrease of 0. 13% of the exercise counselling alone group (Balducci et al., 2010). 4. The aim of this study by Honkola et al., 1997) is to define the effect of circuit-type resistance training on HbA1c and other metabolic health related factors. Thirty-eight T2DM participants from Finland participated in

this controlled study, both genders, aging between 60 and 69. Baseline HbA1c range from 7. 5% to 7. 7%. Intervention: A 5 months controlled study divided into 2 groups. The intervention group was an individualized progressive supervised circuit-type resistance training programme under supervision of physical education instructor, physiotherapist, nurse and physician twice a week, concentrating on trunk, upper and lower body muscle groups that consisted of 8-10 different movements per circuit and 12-15 repetitions were performed at each station. The control group was directed to follow a correct diabetic regime, with no change in eating habits. Results: A decrease in HbA1c was rather small in the intervention group, at 0. 1%. In the Control group, there was an increase of HbA1c of 0. 4% (Honkola, Forsen, & Eriksson, 1997). 5. The aim of this article by Church et al. (2010) is to examine the benefits of aerobic and resistance training alone and a combination of both on HbA1c in individuals with T2DM. Two hundred and sixty two T2DM individuals from Louisiana of both genders with an HbA1c level of 6. 5% to 11. 0%. The individuals ages from 30 to 75. A randomized controlled trial group with T2DM were enrolled in a 9 month exercise program. The trial was evaluated into 4 different groups that consisted of a control group and 3 different exercise groups: aerobic training only, resistance training only and a combination of both. The control group had access to weekly stretching and relaxation sessions and were requested to maintain current activity throughout the 9 month study period. The resistance training group exercised 3 days/wk focussing on different upper and lower body exercises working on different type of exercise machines such as; bench press, seated row, shoulder press, pull down leg press, extension, and flexion, abdominal crunches and back extension. Participants

assigned to the aerobic exercise consisting of treadmill (walking pace and the grade increased by 2% every 2 minutes until exhaustion). Individuals assigned to the combination exercise group were initiated to aerobic and resistance training, upon reaching a target level, the recommended weight was increased on the machines. All exercise sessions were supervised and practiced 3 days/wk for a total of 150 minutes. From 262 randomized participants, 250 completed the trial. The absolute change in HbA1c following this trial: The combination group decreased its HbA1c of 0. 34 %The aerobic group decreased it’s HbA1c of 0. 24 %The resistance group decreased it’s HbA1c of 0. 16 %And the control group increased its HbA1c of 0. 18% (Church et al., 2010). 6. The aim of this randomized crossover experiment by van Dijk, Tummers, Stehouwer, Hartgens and van Loon (2012) is to investigate the impact of daily exercise versus exercise executed every other day on glycemic control in T2DM individuals. Daily exercise is suggested to maximize the outcome of exercise for glycemic control. Thirty T2DM male patients age 59 to 61 years old from NL, with a mean HbA1c level of 7. 2%. This is a short 48 hours randomized crossover experiment over strict diet and physical exercise regime but otherwise free-living conditions. The study consists of 3 intervention periods which were separated by a 4 day pause. Each intervention period consisted of 3 days during which the impact of moderate-intensity cycling exercise on 48-h blood glucose homeostasis was assessed under standardized dietary, but otherwise free-living, conditions. All intervention periods were identical with the exception of the frequency and duration of the exercise period. For the nondaily exercise session; a single 60 minutes cycling session was performed at the beginning of the 48 hour study and in the daily exercise

group session; two cycling sessions of 30 minutes each were performed; the first at the beginning of the 48 hour study period and the second cycling session 24 hours later. In a third intervention period " control", subjects performed no exercise at all. Throughout each experimental session, candidates were provided with a healthy consistent diet. The diet consisted of three lunchtimes and three snacks per day. All 30 candidates were compliant with respect to their diet and medication, also successfully completed the three experimental treatments. The benefit of exercising 60 minutes or two 30 minutes sessions over a 48 hour period equally decreases glucose concentration of 10%. Significantly lower compared with the control trial that showed no variations in glucose level (van Dijk, Tummers, Stehouwer, Hartgens & van Loon, 2012). 7. The aim of this study by Goldhaber-Fiebert, Goldhaber-Fiebert, Tristan and Nathan (2003) is to determine if a community-based health intervention addressing nutrition and exercise can be beneficial to improve glycemic control in T2DM and other cardiovascular risk factors in rural Costa Rica. Seventy five adults from Rural Costa Rica with T2DM, both genders, mean age of 59, with a mean HbA1c level of 8. 6%. This 12 week randomized controlled pilot study was conducted with T2DM volunteers from three small communities. The activity for the Intervention group consisted in 60 minutes walking group sessions three times per week. The control group were advised that they would be offered a comparable program following this study. The candidates were also offered weekly nutrition classes for lifestyle intervention purposes. The health value of type 2 diabetes patients in the intervention group from walking 60 minutes three times per week was significant to decrease HbA1c of 1. 8%. And the control group also had a decrease HbA1c of 0. 4%. From 75

participants, 61 completed the program (Goldhaber-Fiebert, Goldhaber-Fiebert, Tristan & Nathan, 2003). 8. The aim of this study by Castaneda et al. (2002) is to evaluate the effectiveness of high-intensity progressive resistance training (PRT) on glycemic control in older adults with T2DM. A randomized controlled trial in Boston including 62 Latino older adults, both genders, aging between 58 and 72 years of age with an HbA1c level of 8. 1% to 9. 0%. This16 weeks randomized controlled trial directed towards T2DM in the elderly population. Divided in 2 groups; progressive resistance training group (PRT) and the other identified as control group. The PRT group participated in a 45 minutes supervised exercise session consisting of 5 minutes warm up, 35 minutes PRT using five pneumatic resistance training machines, working on chest, legs and upper back routine exercise followed with a 5 minutes cool down of flexibility and stretching exercises, all practiced three times per week. The PRT was aimed to provide progressive increases in intensity with sporadic weeks of decreased intensity to reduce risk of injury and over-training and to improve results. The control group received phone calls every 2 weeks and came for testing during baseline, mid- and post study. They also received diabetes recommendations for self-managing, and were not given nutritional advice other than to follow recommendations given by their health care providers. There was significant improvement in HbA1c in the PRT group a decrease of 1. 1% compared to the control group with a decrease of 0. 1% (Castaneda et al., 2002). 9. The intention of this study by Ng, Tai, Goh, and Wee (2011) was to compare the effects of progressive resistance training (PRT) and aerobic training (AT), of similar volume and duration, with middle-aged candidates with T2DM. Sixty males' aging from 51 to 65 with a baseline HbA1c level of 8. 7%. An 8 week

randomised trial in Asia directed towards 60 T2DM subjects that participated in a PRT and AT. The PRT group practiced 9 different resistive exercises (three sets of 10 repetitions) and the AT group underwent 50 minutes of aerobic training. There was minimal difference in HbA1c between each group, a decrease of 0. 5% in the PRT group and a decrease of 0. 6% in the AT group. The PRT group also showed a reduction in waist circumference by 1. 8 cm (Ng, Tai, Goh, and Wee, 2011). 10. The intent of the study by Dunstan et al. (1998) was to assess the effects of short-term circuit weight training (CWT) on glycemic control in NIDDM. Twenty-seven untrained sedentary subjects, mean age of 51, both genders with a baseline HbA1c of 8. 15%. An 8 week randomized controlled study in Australia concentrating on individuals with NIDDM. The 27 candidates we're divided into 2 groups: a short-term circuit weight training (CWT) group and a control group that practiced in no formal exercise. All candidate underwent strength testing using free weights and universal machines and were given two familiarisation sessions and shown proper exercise technique directed by a trained instructor and supervised by both instructor and physician. The CWT was performed on three non-consecutive days of the week, 60 minutes per sessions, consisting of a warm up and cool-down, stationary cycling with minimal resistance and riding at 60 revolutions per minutes, followed by a series of appropriate flexibility exercises. The exercises were performed on a gradual setting to allow physical adaptation to the activity and by the third week of the study, 10-15 repetitions (two sets followed by three sets) were performed for the remainder of the study. Strength testing was repeated after 8 weeks for all participants. Throughout the study period subjects were reminded to maintain their usual dietary habits. No injuries or complications

occurred through the study. Strength for all exercises improved significantly after CWT compared to controls. Twenty one subjects completed the study. There was minimal difference in HbA1c: A decrease of 0. 2% in the CWT group and an increase of 0. 2%in the control group. A decrease weight of 0. 4 kg was noted in the CWT group (Dunstan et al., 1998). DISCUSSION Following these series of interventions practiced with the intent to improve glycemic control in T2DM candidates, ten randomised controlled trials were explored in this review. A total of 1249 individuals participated in the assigned studies from different countries such as Australia, United States, Italy, Finland, Louisiana, Netherlands, Costa Rica and Asia. The number of participants in each individual study ranged from 27 (Dunstan et al., 1998) to 606 (Balducci et al., 2010) candidates. The mean age of groups was 61. Both exercise alone and exercise supplemented with a nutrition regime, have significantly improved glycemic control as indicated by decreasing HbA1c to 0. 8%, which in turn effectively decreased the incidence of T2DM. Duration and FrequencyExercise interventions ranged from 3 days to 12 months. Most interventions involved two to three exercise sessions weekly with sessions occurring mostly on non–consecutive days. This allows recovery and adaptation principles of exercise indoctrination and programming. Duration of exercises sessions varied from 30 to 75 minutes and 2 studies (Honkola, Forsen & Eriksson 1997), (Ng, Tai, Goh, and Wee 2011) did not include duration of exercises. O et al.....**********r do I putType of exerciseThe studies included diverse types of exercises, both resistance and aerobic training and combination of both such as stationary cycling with different intensity resistance training, treadmills, walking, rowing machines, step, elliptical, arm or cycle ergometer, free weights and multiple-station

weight devices, resistance training, flexibility exercises and nutrition classes. Shortest study vs longest studyThe effectiveness of the interventions in relation to decreasing HbA1c was potent considering a short study from van Dijk et al. (2012) completed in 48 hours compared to the longest study of 12 months by Balducci et al. (2010). Evaluating van Dijk et al. (2012); short sessions of cycling completed on a daily basis are equally effective as lengthier cycling period performed every other day to improve glycemic control in T2DM with a decrease of 1. 0% HbA1c. A healthy consistent diet was also offered in this study. In Balducci et al. (2010), the longest study trial of 12 months in duration included 2 weekly sessions of aerobic and resistance training with a decrease of 0. 42% HbA1c. The control group received non-supervised exercise counselling alone and also indicated a small decrease of HbA1c of 0. 13% which is substantial considering it was performed as a non-supervised activity. (Balducci et al., 2010)In Church et al. (2010), It is important to appreciate the difference in HbA1c between the combination training group and the control group in this 9 month study that occurred and the control group had increased their dose in diabetes medications while the combination training group reduced its diabetes medication use. Confirmed that effective controlled exercise programs for our T2DM population in an extensive monitoring setting. Both aerobic and resistance training were helpful with a low dropout rate. The group was able to tolerate the exercise regime which has a significant implication. All 3 exercise regime were valuable although the combination exercise program was greater in lowering HbA1c. This significant decrease in HbA1c in the combine group may very well be associated with the prescribed training weight that was increased as the participant reached a target level of

endurance as a result in increased muscle strength. Also, only the combination training group had a weight loss and gained other health benefits in comparison with the aerobic and resistance training alone. Both the combination and resistance training groups lost fat mass compared with the control group, the aerobic group did not lose any fat mass (Church et al., 2010). Comparing #4 lowest decrease of HgA1c ant highest #7Improvement in glycemic control are compared in both the best results achieved in this review and the lowest level attained. Ranging from a decrease in HbA1c to 1. 8% obtained in this study by Goldhaber-Fiebert et al. (2003) in rural Costa Rica, a 3 months study consisting of weekly nutrition classes and walking 60 minutes 3 times/wk. Families were invited to weekly nutrition classes and to participate in joining the walking group which valued the importance of the simple activity. It is great that within a small community, nutrition and exercise intervention for T2DM, lead into peer groups, and can be effective by implementing a simple activity such as walking in developing countries and resulting in such a significant improvement in health while providing prevention in T2DM at a low cost activity. The control group decreased their HbA1c, likely from benefiting from the nutrition classes as they didn’t participate in any physical activity. The lowest level attained with a decrease HgA1c of 0. 1% is by Honkola et al. (1997), a circuit type resistance training exercise, concentrating on trunk, upper and lower body muscle groups that consisted of 8-10 different movements per circuit and 12-15 repetitions were performed at each station. The benefit of this type of study by Honkola et al. (1997) was not significant as to decrease the subjects’ HbA1c. Resistance training is practiced in individuals that want to increase their athletic performance while increasing strength and building muscles along with

resistance. The main goal of this kind of training is the development of maximal strength and power for athletic performances. However, this kind of training incudes a high risk of cardiac and vascular complications for diabetic subjects. T2DM is mainly a disorder of older individuals, and the decline in muscle mass with aging is associated with a decline in metabolic function, supporting the usefulness of resistance training in the diabetes treatment regimen (Honkola et al., 1997). As indicated in the study by Castaneda et al. (2002), properly controlled and recommended high-intensity resistance training demonstrated both achievable and effective among older adults with T2DM, resulting in improved glycemic and metabolic control. It is highly recommend resistance exercise training may be useful as an adjunct to standard medical care in the management of patients with diabetes (Castaneda et al., 2002).

Conclusion

This literature review demonstrate that exercise alone or in combination with appropriate eating habits can significantly decrease HbA1c by 0. 8% and improve other related health factors. According to a study in the Diabetes Care: " Epidemiological analysis showed a continuous association between the risk of cardiovascular complications and glycaemia, such that for every percentage point decrease in HbA1c, there was a 25% reduction in diabetes-related deaths, a 7% reduction in all-cause mortality, and an 18% reduction in combined fatal and nonfatal myocardial infarction" (Genuth et al., 2003). This review involved several types of physical exercises, the most valuable exercise is the one that is best suitable for each individual also adaptable to lifestyle, schedule, and budget or whatever will promote each person to

exercise. The easier the exercise is to maintain, the more likely it that the individual will continue it. Promoting an easy activity such as walking or cycling instead of using a motor vehicle is a great way to initiate physical activity on a daily routine. Considering the impact and value on exercising in lowering HbA1c, promoting by awareness advertisement and education would be beneficial as a prevention method in our increasing diabetic population, especially children and adolescents with T2DM. Promoting physical activity at a younger age and educating on the important value to better health and a prolonged life expectancy. Physical activity is essentially a personal commitment and discipline that can be difficult for many individuals to prioritize in their sedentary lifestyle, particularly introducing this type of lifestyle modification later in life when some health factors take in effect as our population’s general health declines." Community-based nutrition and exercise interventions can significantly reduce risk factors for diabetic complications." (Goldhaber-Fiebert, Goldhaber-Fiebert, Tristan & Nathan, 2003).